A Glimpse at the World of Fishermen in Puerto Rico:
A Global Perspective

Manuel Valdés Pizzini
in collaboration with Michelle T. Schärer Umpierre

A publication concerning public policy from the University of Puerto Rico Sea Grant College Program and the Interdisciplinary Center for Coastal Studies

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Summary

A Glimpse at the World of Fishermen… presents guidelines about fishing development in Puerto Rico and its future possibilities. By analyzing several socioeconomic, environmental, and fisheries' studies, as well as the author's own research, this document offers suggestions and recommendations about critical aspects that must be considered by every entity and by everyone involved in fishing, most notably: universities, local and federal governments, scientists, the private sector, and the fishermen.

Frequently, fishermen—who are the ones responsible for formulating public policy—and the public at large ask themselves: What can we do to promote fishing in Puerto Rico? Why don't we do more to boost such an important economic activity? Why don't we utilize the enormous fishing resources that we have in our waters? This work attempts to answer those questions through the analysis of data and the research of historical information, and by suggesting alternative actions and possible solutions.

The research of environmental, fishing, economic, and political factors that have shaped local fisheries comprises a key piece when it comes to offering answers. Additionally, examples from several locations around the world are examined in order to help clarify our situation in regard to fishing as well as to put it in perspective. The analysis of the aforementioned factors and examples contributes significantly to the understanding of what has transpired in Puerto Rican fisheries.

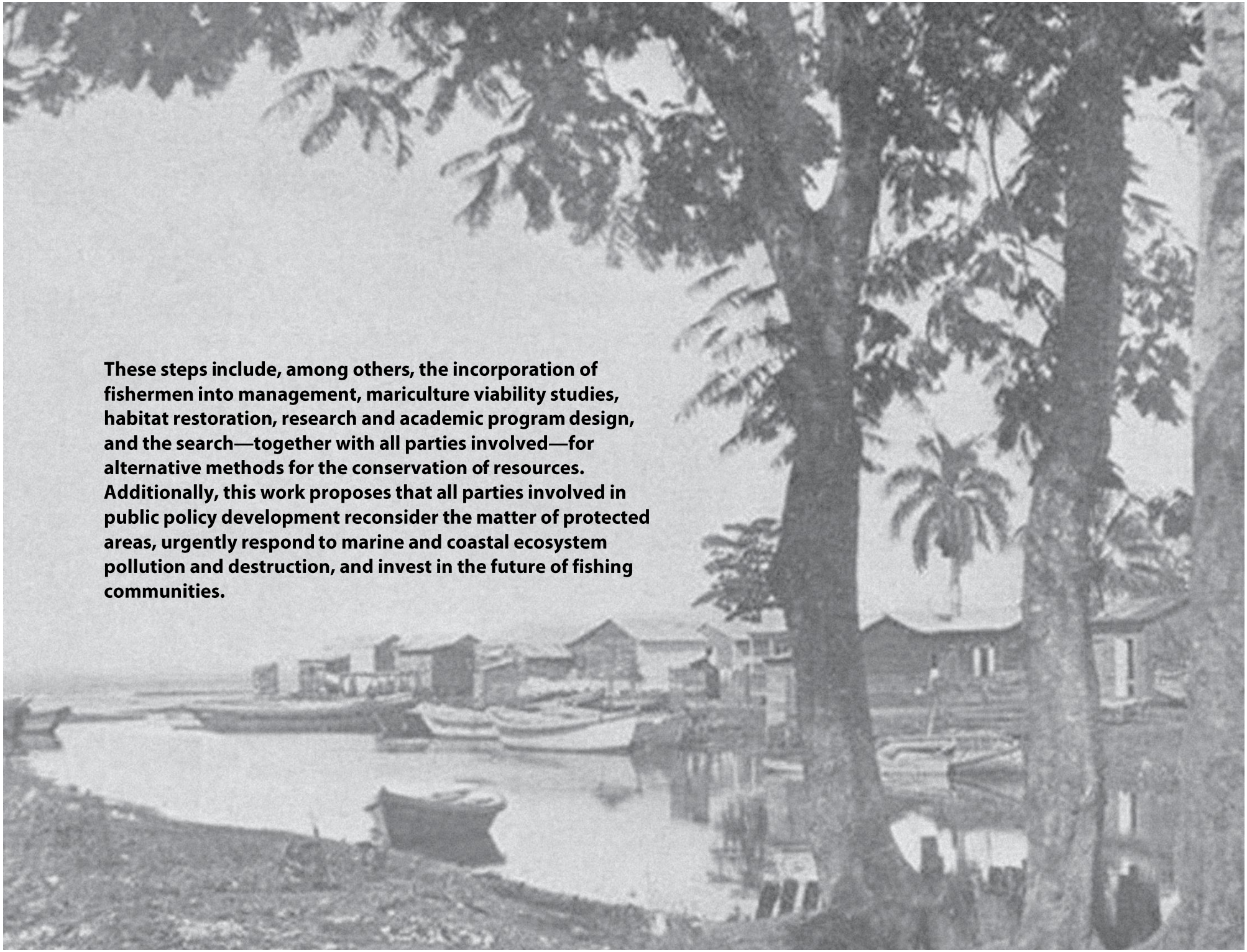
It is worth mentioning that the situation of global fisheries is, at this time, precarious. For years, several industrial fishing fleets have mercilessly exploited the resources of various seas and regions of our planet. As a result of the fishing burden—especially technology-based fishing—many species have been vanishing. The dwindling of species has adversely impacted fishing communities and threatens fishing cultures around the globe, who are also being displaced by tourism and coastal development. In addition, the collapse of the fishing supplies has caused a reduction in government fishing subsidies, since they do not want to invest in an activity whose economic revenue is decreasing. Fishermen and businessmen in the sector have depended on subsidies and incentives to enhance their vessels and obtain new fishing gear. Nevertheless, there is a global moratorium on those subsidies. Such is

the case in the United States.

This work discusses—specifically, criticizes—the topic of overfishing in Puerto Rico and the most outstanding aspects of fishing activities; in addition, cultures and societies of fishermen are described from a historical perspective. It also goes in depth into the fishing development process, an aspect which—for diverse historical, economic, and environmental reasons—has been largely ignored. Therefore, the achievements and the efforts to develop the fisheries are detailed. Among them, the motorization of fleets, credit offering for buying equipment and engines, and the development of fishing villages. This study asserts that optimal conditions for fishing development never arose in Puerto Rico as they did in other countries around the world, such as Cuba. In contrast with these countries, fishing development in Puerto Rico, even in critical areas such as Cabo Rojo, has been localized and fragmented. Although it had its heyday—approximately from 1930 to1990—it has since reached an impasse. It could have become an important fishery for pelagic resources and species known to be highly migratory, which abound in the Exclusive Economic Zone. Those resources were exploited on a large scale by American fleets until very recently. That was an opportunity we let slip though our fingers. The development of the fishing industry in the United States, on the other hand, is showcased as an example of development, but not without debate regarding the levels of progress reached and the none-too-auspicious future.

This study outlines a list of extremely urgent topics to be taken into consideration for the wellbeing of the fishing industry and fishermen in Puerto Rico. These topics include, for example, the precarious situation of habitats, the impact of development on ecosystems, the threat of hurricanes and climate change, the impact of development on fishing communities and their way of life, competition within recreational fishing, fishing for sport, commercial fishing, the agendas of several world environmental organizations against fishing, the quality of the capture data, the need to integrate fishermen into the management of fisheries, the need to understand the socioeconomic role of fishing, the need to accurately transfer the available technical information to everyone involved in the fisheries, and the understanding of environmental injustice processes.

Finally, this document proffers a series of steps to follow in order to formulate an ideal public policy for the development of the fishing industry.



These steps include, among others, the incorporation of fishermen into management, mariculture viability studies, habitat restoration, research and academic program design, and the search—together with all parties involved—for alternative methods for the conservation of resources. Additionally, this work proposes that all parties involved in public policy development reconsider the matter of protected areas, urgently respond to marine and coastal ecosystem pollution and destruction, and invest in the future of fishing communities.

Abstract

Una mirada al mundo de los pescadores... (A Glimpse at the World of Fishermen...) contains a thorough discussion on the history, the present, and the future of fisheries development in Puerto Rico. Through the review and analysis of a number of studies, this document offers an array of recommendations on critical issues that should be considered by all of the stakeholders involved in Puerto Rican fisheries. Oftentimes, fishers, policy makers, legislators, and the general public ask the following questions: What can we do to promote fishing in Puerto Rico? Why don't we exploit the vast fishing resources that we have in our waters? Answers to those questions are provided here, through the presentation of case studies from around the world, and the proposal of alternatives and possible solutions.

In a nutshell, a tropical insular system, characterized by oligotrophic waters and dominated by species associated to coral reefs, lacks the abundance and biomass to sustain a large fishing endeavor. In that context, the development of Puerto Rican fisheries is discussed in depth, and the small advances and efforts to aid the local fisheries are described in detail, including the motorization of the fleet, the availability of credit for the purchase of equipment and engines, and the construction of fishing facilities and infrastructure for the fishermen. Overfishing is considered, worldwide, the culprit for the collapse of the stocks. For many years, a number of industrial fishing fleets have mercilessly exploited the resources of various seas and regions of the planet. However, in small-scale fisheries, there are other factors impacting them, such as habitat destruction and degradation. This document critically discusses the issue of overfishing in the case of Puerto Rico. Throughout the document the author draws attention to the importance of engaging in an Ecosystem Based Approach to Management. In a practical sense, Puerto Rico has to address a number of critical issues, to start dealing with the well-being of fishers and of fisheries. These issues are the following: the precarious situation of ecosystems, the impact of development on ecosystems, the threat of hurricanes and climate change, the impact of development on fishing communities and their way of life, competition from recreational and sport fishermen, the need for better data on the stocks and the landings, the need to integrate fishers into the management process, and the need to understand the socio-economic role of fishing, among others.

Finally, this document proposes a series of steps in the formulation of a realistic public policy for local fisheries. This document underscores the following alternatives to accomplish such a comprehensive policy, such as: the incorporation of fishers in management, the study of the feasibility of mariculture projects, the consideration of habitat restoration, the design of appropriate research and academic programs, and the sustainable use and conservation of resources. Furthermore, this work proposes that the stakeholders involved in the fisheries should also pay attention to the prospect of protecting the fisheries' resources, including marine reserves, not as a panacea, but as a strategy to contribute to the wellbeing of the ecosystems and stocks.

Acronyms

CFMC	Caribbean Fishery Management Council (Consejo de Pesca del Caribe) http://www.caribbeanfmc.com/
CIEL	Interdisciplinary Center for Coastal Studies (Centro Interdisciplinario de Estudios del Litoral) http://amp-pr.org/ciel
CIP	Fisheries Research Center (Centro de Investigaciones Pesqueras) (Cuba)
CODREMAR	Corporation for the Development and Administration of Marine, Lacustrine, and Fluvial Resources of Puerto Rico (Corporación para el Desarrollo de los Recursos Marinos, Lacustres y Fluviales)
CRES	Coral Reef Ecosystem Studies (Estudios del Ecosistema de Arrecifes de Coral) (University of Puerto Rico)
DRNA	Department of Environmental and Natural Resources (Departamento de Recursos Naturales y Ambientales) http://www.drna.gobierno.pr/
EEZ	Exclusive Economic Zone (Zona Económica Exclusiva)
ELA	The Commonwealth of Puerto Rico (Estado Libre Asociado)
EPA	Environmental Protection Agency (Agencia de Protección Ambiental) http://www.epa.gov/espanol/
FMP	Fishery Management Plans (Planes de Manejo de Pesca)
NMFS	National Marine Fisheries Service (Servicio Nacional de Pesquerías Marinas) http://www.nmfs.noaa.gov/
NOAA	National Oceanic and Atmospheric Administration (Administración Nacional de los Océanos y la Atmósfera) -- http://www.noaa.gov/
PRACO	Puerto Rico Agricultural Corporation (Corporación Agrícola de Puerto Rico)
PRERA	Puerto Rico Emergency Relief Administration (Administración para Ayuda de Emergencia a Puerto Rico)
PRRA	Puerto Rico Reconstruction Administration (Administración para la Reconstrucción de Puerto Rico)
TEK	Traditional Ecological Knowledge (Conocimiento Ecológico Tradicional)
UNCLOS	United Nations Convention on the Law of the Sea (Convención de las Naciones Unidas para la Ley de los Océanos) -- http://www.unclos.com

Preface

In the year 2001, I received an invitation from Senator Cirilo Tiradoto speak at a conference concerning the future of fishing in Puerto Rico. It was the Senator's genuine wish for me to lecture on the potential of fishing and the ways in which the federal government could aid this development. However, this is a pattern that we have observed before, particularly around election time, where legislators propose legislation and resolutions to help the fishing sector and to study the ways in which we can take advantage of the waters that surround us, thereby developing important fisheries. I believed it was time to put things into perspective, to understand the history of fishing, and to draw attention to the current situation of fisheries in Puerto Rico and the obstacles confronting them.

Although my lecture was generally not well received, some colleagues admitted, in private, that they agreed with what I had said at that time. Two people in the audience made incisive inquiries about my position and asked me to clarify some points. These people were Edwin (Paúco) Font, a fisherman from Rincón, and Félix (Felí) Morales, a fisherman from Aguadilla.

I have learned much from both of them, through long conversations regarding fishing. I thank them for their comments on the lecture, since their questions led me to expand and publish it as a work on public policy in the fishing sector and to recognize the potential it has for further development.

My participation with the Tres Palmas Marine Reserve has allowed me to continue my conversations with Paúco, a continuing education of sorts for me regarding the potential of our fishers. While writing these lines, I cannot stop thinking about all those men and women who dreamed of a better future for fishing. I will refrain from mentioning any names, for the fear of excluding so many people that are committed to fishing and to fishermen.

The information that has been gathered in this work is the product of various research projects, some of them funded by the University of Puerto Rico Sea Grant Program and by the National Oceanic and Atmospheric Administration (NOAA). During the research backed by Sea Grant, with the support of Manuel Luis (Manelí) Hernández Ávila (RIP) and the mentorship of Jaime Gutiérrez Sánchez, I began formulating many of the ideas that are presented in this work. My participation in a project that was

documenting the socioeconomic profile of the fishing communities in Puerto Rico and in Saint Croix, in the US Virgin Islands, gave me the opportunity to expand my perspective on fisheries and to absorb the ideas and the extraordinary knowledge of my colleagues David C. Griffith, Carlos García Quijano, and Juan J. Agar. However, what has been written in this work is the product of my participation in the Coral Reef Ecosystem Studies (CRES) program, managed by Richard Appeldoorn from the University of Puerto Rico (Mayagüez Campus) and Michael Dowgiallo of NOAA. The insistence of these colleagues to produce useful information for management motivated my writing of this work. It is published thanks to the sponsorship of the Fisheries Extension Enhancement Grant from the National Sea Grant College Program.

I started the writing of this work at exactly the same time that the Interdisciplinary Center for Coastal Studies or CIEL (Centro Interdisciplinario de Estudios del Litoral) started to develop, whose members used to work in a circular debate. I am certain that many ideas in this work emerged from conversations with Michelle T. Schärer Umpierre, Idelfonso Ruíz Valentín, Carlos J. Carrero Morales, and Alfonso J. Aguilar Perera. I am grateful to Michelle T. Schärer Umpierre for her suggestions concerning the cases of red hinds and lobsters, which she wrote in order to enrich this document and offer a more profound level of detail.

This work has been read critically by my friend and colleague Ruperto Chaparro, whose vision concerning the world of fishermen is always accurate, just, and respectful. To establish a critical balance and to obtain commentary with a solid institutional basis, we asked Miguel A. Rolón, executive director of the Caribbean Fishery Management Council (CFMC), and Aida Rosario, director of the Fisheries Research Laboratory of the Department of Natural and Environmental Resources (DNER), to comment on this work. With their editorial comments and suggestions, we published it with moderation, erasing all trace of the style commonly found in pamphlets.

This work is meant to initiate a dialogue among all the parties involved. Rather than constituting the final word, I prefer that it serve as a first or second word, and that from this text a debate will arise in villages and fishing boards, federal and local committees, governmental offices, classrooms, ships, and public hearings. I also hope that it will allow us to expand our vision and to recognize and resolve our differences, while discovering new data and fountains of information to support our ideas and to contribute to the potential of fishing.

When I started to work on this text, I had the invaluable help of Alfonso J. Aguilar Perera, whose love for words, for equilibrium, and for technical and scientific knowledge bettered many of my writings in the CIEL—this work included. I also thank Edgardo Ojeda Serrano of the Sea Grant College Program for his commentary.

From one draft to the next, it has been Cristina D. Olán Martínez, Sea Grant's editor and communications officer, who has put all her energy in this text and has battled with a difficult and stubborn writer, whom she has convinced of his immoderations and his language slips, paragraph by paragraph, page by page. Mydalis M. Lugo Marrero, always with great precision and discipline, put the final touches on the editing of this work. I also thank Oliver Bencosme Palmer for his patient and creative work on the diagrams in this publication.

I am most genuinely and enthusiastically grateful to the people, colleagues, friends, and agencies I have mentioned here. Without their selfless help, knowledge, recommendations, and suggestions, this work would not have been possible.

Finally, I want to dedicate these pages to Ana Krystalliá, Carmen Margarita (Menshy), Ángelo Elías, and Vallari Victoria, who form part of two beautiful generations that have made me profoundly happy and for whom I write all of this.

Introduction

What can we do in order to promote fishing in Puerto Rico? Why don't we do something to encourage such an important economic activity? Why don't we utilize the enormous fishing resources that we have in our waters? Why haven't we been capable of possessing these resources for ourselves? What obstacles have there been that have prevented us from having our own industrial fleet? What can we do today to change the course of fishing? In Puerto Rico, many people ask themselves these questions but have trouble finding any answers.

Every four years, efforts arise—most of them well intentioned—to change the outlook of the fishing industry. Relying on forums and debates on the future of fishing, the delivery of ships and of the methods of fishing, as well as studies derived from legislative projects, they try to respond to some of the aforementioned questions. Unfortunately, the answers are not simple, clear, or definite. To find valid answers, it is necessary to have a historical and comparative perspective with other countries that have invested the time and money in the development of fishing.

For example: Canada, the United States, the former Soviet Union, China, and Cuba decided to invest great efforts in the development of their fleets. The question is: Can Puerto Rico do the same? If we can expend a significant effort in order to develop fishing, what should the public policy be on the future development of fisheries? In this document, I present answers to the aforementioned questions, based on economic, historical, biological, and oceanographic studies. By scrutinizing the past, examining what has transpired in other countries, and focusing on the future, we can gain a more precise idea of the future of fishing in Puerto Rico. This study offers several possible scenarios concerning said future.

My interest in fishing was stimulated by Neftalí García's 1970s work on "the ideology of poverty." This environmental scholar proposed that Puerto Rico's political condition was manifested in a set of false ideas concerning its richness; because of this we were taught that Puerto Rico was extremely poor, when in fact it was very rich. Thus, this political-economic situation translated into a bleak vision of our surroundings and of our resources. If this premise was true, then it was important to apply it to the fishing sector. How is it possible that while having such an enormous ocean—the very one contemplated by the poet Pedro Salinas—in front of us, our fishing

production was not commensurate with such oceanic vastness?

In the search for the answers to these and many other questions, I started to investigate the fishing sector in 1979. Various studies led me to research diverse aspects of the fishing industry and to correct some erroneous assumptions, one of them related to the relative richness of our fishing resources. Firstly, it is appropriate to point out that the simple fact that the archipelago of Puerto Rico is located between the Atlantic Ocean and the Caribbean Sea is not equivalent to having a significant richness in fishing resources. Tropical waters are very rich in **biodiversity**, which means that they possess a high variety of species.[1] However, the abundance of species and organisms per area (**biomass**) is very low in comparison with other ecosystems.[2] The extension of the submerged area where these organisms and their **habitats**[3] are found constitutes a variable of great importance; the greater the extension, the greater the biomass. Therefore, on an island where the shelf edge (border of the insular shelf) is close to the coast, the quantity of organisms per acre of submerged land will be lower than in places where the shelf that shelters them is wider. Another significant variable is the habitats that form the insular shelf, namely seagrass meadows, mangroves, estuaries, and coral reefs. For this reason, the west coast of Puerto Rico is very rich in fishing, in comparison with the rest of the insular shelf, since it presents one of the most extensive and diverse habitats in all of Puerto Rico. The wider the insular shelf is, the greater the space and opportunity for survival available to marine species.

Our coastal waters and their geological shelf are very narrow and relatively low in nutrients. In other ecosystems, such as in temperate zones in northern seas, **plankton**[4] (combination of zooplankton and phytoplankton) is highly abundant, which translates into a greater availability of food for the enormous populations of fish. The fish populations in northern seas have adapted themselves to feed on the enormous quantity of plankton, nutrients,

[1] Biodiversity is the number, quantity, and diversity of species present in a specific habitat or environment; that is, the richness and the biological and genetic diversity of species.

[2] The biomass is the total weight and volume of animal and plant life in a given area.

[3] A habitat is the place where diverse organisms and communities of organisms live and interact with the environment.

[4] Plankton is the name that is given to organisms, the majority of which are microscopic, that live in coastal and oceanic waters and that are adrift. Plankton may be classified as vegetable (phyto-) or animal (zoo-).

fish, invertebrates, and other food sources available in these waters. This is the reason why they have evolved into such huge populations that move through vast distances of water, in order to capture and consume food and to implement reproductive strategies that allow them to produce enormous quantities of eggs. However, our waters, which scientists call **oligotrophic**—that is, waters that are scarce in nutrients, where very little plankton is produced—do not have a high density of phytoplankton and zooplankton; therefore, it cannot sustain large populations of fish. This means that in the waters over the insular shelf, there is not enough biomass to sustain fishing activity beyond about 4 to 5 million pounds per year.

The deep waters surrounding Puerto Rico are different, since in them and in the waters that are close to the coast, there is a large upwelling of nutrients that attract fish that live in the water column, better known as **pelagic fish.**[5] These fish move in large shoals, which reflect a significant biomass. Tuna fish, wahoos, king mackerels, dolphinfish, swordfish, and marlins are abundant in these waters. In the 1980s and 1990s, these fish were the main target of North-American and foreign **longline fishing vessels**, which extracted a large quantity of catch for years.[6] The data on these landings is very schematic and it barely contributes to the understanding of the impact of this fishery.

Important fishing banks exist close to Puerto Rico, in shelf zones in the middle of deep-sea waters that are apt for the fishing of silk snappers, queen snappers, and groupers. Several examples of these significant banks, in the west area, include: Pichinco, El Banco del Medio, El Guineo, El Tostón, and El Bajo de Sico, among others. In the 1980s these areas sustained a significant fishing effort; since then, they have been important areas for the fishing of silk snappers and queen snappers with the use of electric winches. Little is known about these areas—practically nothing, in fact—due to their immense depth, which is between 200 and 300 meters.

[5] Pelagic fish are those that live and move in oceanic waters or in the open sea.

[6] The longline fishing vessels, recognized by all our fishermen, are fishing vessels that work with longlines, which is, in this case, an art that uses hooks that are tied to an extensive main line that may be many miles long. The longline has flotation points, using buoys, and each segment carries a large quantity of baited hooks. The longline is placed at different depths to capture different species and it is brought onboard by using a gigantic hydraulic reel that is mounted on the vessel, to reel in the main line, the smaller lines attached to them, and the catch, which is extracted manually.

The Critical Condition of Fishing Resources on a Global Scale

In short, the fishing resources of Puerto Rico are diverse, but their abundance does not reach the magnitude necessary to sustain an industrial fishing fleet prepared to extract fish constantly, since the populations are relatively small, the abundance of nutrients is small, and the space to maintain such populations is minimal. However, local and foreign fishermen have ventured into the fishing banks outside the shelf and have accessed relatively abundant pelagic resources.

The shortage in fishing stocks constitutes one of the most distressing worldwide issues. For many years, various industrial fishing fleets have exploited, in a ruthless manner, the resources of different seas and regions on the planet. For example, the fishing banks in Newfoundland, Canada, were once very rich in Atlantic codfish (*Gadus morhua*). This abundance attracted the Basque, the Spanish, the French, and the British, who arrived to fish in these waters. Newfoundland was one of the major providers of codfish in the world, perhaps even the most important. But new technologies in fishing, industrial vessels, and the high investment of capital produced an enormous effort that, paradoxically, diminished landings, in comparison with previous years.

The fishing industry there capacitated itself beyond what the codfish stocks could sustain. The result was the collapse of the resource and the closing of this fishery in 1992. There were no more codfish; more than 50,000 people lost their jobs. Many of them had to migrate to other parts of Canada and abandon their traditional coastal communities. Canada has recently reopened the codfish fishery, closely and cautiously observing the stock, in order to permit its recovery.

However, the great powers—rich and industrialized countries—have increased their consumption of fish, much of which is provided by poor countries or developing countries. The signs of globalization can be appreciated in Puerto Rican supermarkets by looking at the packaging: codfish from China (in reality it is pollock, which belongs to the order gadiformes, and is a member of the three genera considered to be true codfish), octopus from Thailand, shrimp from Vietnam, and groupers and silk snappers from India, Venezuela, Sri Lanka, and Mexico. The consumption of fish, aimed at the reduction of cholesterol and cardiovascular disease, has triggered the demand for fish in developed countries. In Puerto Rico, the production is not sufficient to satisfy the potential demand for fresh fish. It is important to note that

Puerto Rico imports approximately 85% of the fish it consumes.

The demand for these products and for competitive prices on the market promotes the utilization of these resources through better technologies and an increase in the number of fishermen. For many analysts, this demand and the resulting increase in efforts leads to what is known as **overfishing.**[7] In addition, the shortage in fishing resources in our archipelago is also associated with the destruction of habitats, sedimentation, and the contamination of water.

Globally, there exists a matrix of critical issues and situations that fishermen and their communities are experiencing. Hereinafter, I will synthesize some of these issues that serve as a guide for this discussion and put into context the fishing problems on a global scale:

> The reduction in the quantity of fish landings, due to stock shortages, has as a consequence a decrease in the income of fishermen. Fishermen receive low payment for their catch with no regard for the fact that the commercial price of many species remains the same. This favors wholesalers and retailers, but not necessarily producers.

Fishing communities are displaced due to new urban and commercial developments which expel them from spaces that they have historically occupied. Fishermen are ceding territory to new inhabitants and to development. For example, the history of the fishermen of Chesapeake Bay is that of a gradual social displacement. The old neighborhoods of fishermen and of the workers in the fish processing industry, such as Monterrey and California, to name a few, have become luxurious urban sectors. It is not necessary to go very far to observe these social changes. It happens in Puerto Rico, in towns and sectors such as: Rincón, Aguadilla, Boquerón, and Fajardo, among others. It is a phenomenon that has likewise been recorded in many parts of Latin America.

The increasing fragility of these producers is further aggravated by variations in the weather, the abundance-shortage of the species, fluctuations in prices, and the ups

[7] This is the process by which a species is fished until it can no longer reproduce at a rate to sustain a healthy population, capable of surviving and being fished.

and downs in the job industry. Fishermen are inserted in the logic of various socioeconomic systems: (1) fishing activity with its risks and natural fluctuations, and (2) the opportunities of business and employment in other sectors of the economy that attract them or where they invest part of their time. They do this to supplement their incomes, since fishing is not sufficient to support their families.

Another obstacle that they face is the establishment of a worldwide moratorium on subsidies for fisheries. Fishermen and businessmen of the sector have depended on subsidies and investments to improve vessels and to obtain new fishing gear. However, there exists a global moratorium on these subsidies, except in China. With globalization and **neoliberalism**[8], governments have allowed the invisible hand of the market to be in charge of selecting the most suitable competitors, and have allowed those who can invest and obtain profits do so without state involvement. Nonetheless, the State has not abandoned its administrative responsibilities to protect and

manage fishing resources, even though it also looks for ways to favor the market and free competition. The sale of individual transferable quotas **(ITQ)**[9] constitutes an example of this.

The necessity to conserve resources is part of a global agenda. Some environmental organizations and governments seem to move aggressively toward the conservation of

[8] Neoliberalism is understood as the development of global production and marketing systems, alongside the privatization of public assets and services within the framework of the free market, without the intervention of the State.

[9] The ITQ is a system that assigns a quota of pounds to a firm, a corporation, or a vessel. Said firm, corporation, or vessel is allowed to pass this quota on to another firm by selling it. The European Union, to a large extent, has become a political unit that protects its fishing interest, in that it promotes aid and negotiations, as well as fishing treaties with African countries.

marine resources, in order to safeguard their capacity for recovery and/or their future utilization.

Overfishing

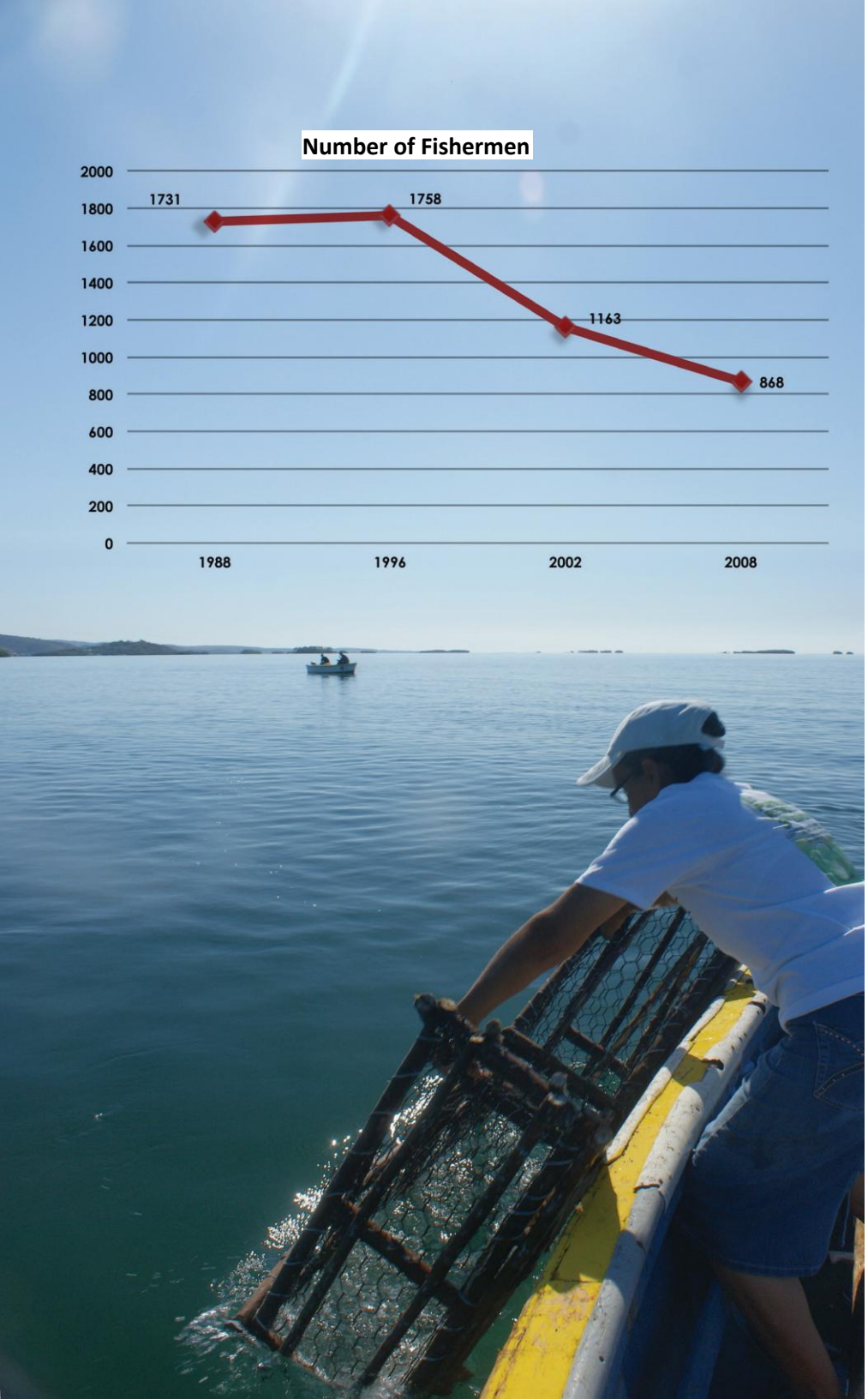
The growing emphasis on the conservation of biodiversity and the protection of ecosystems, species, habitats, and **bioregions**[10] has encouraged governments and environmental non-governmental organizations (NGOs) to put a stop to what they consider to be the central problem of fisheries: overfishing.

Why overfishing? The establishment of factory ships, longline vessels, processing ships, and gigantic industrial fishing vessels, with enormous drift nets, has destroyed ecosystems and exploited species, almost to the point of extinction in some cases. Vast pelagic resources have disappeared rapidly and the populations of tuna are being threatened. The collapse of the stocks of the bowhead whale and the codfish in the Great Banks of Newfoundland hangs, like the Sword of Damocles, over the head of those responsible for the management of these resources. Around the planet, a consistent shortage in fishing stocks has been registered. The rhythm of capture has exceeded the fishes' rhythm of growth and reproduction, since most of them are captured before they have reached sexual maturity. When this happens, management measures must be undertaken to protect the species and to safeguard economic activity. In this section we present two cases (prepared by Michelle T. Schärer Umpierre): one on the lobster and the other on the Nassau grouper.

Does it happen elsewhere in this same manner? Are fishermen the only ones responsible for the shortages in populations and stocks? Are there other causes for the reduction of stocks?

It is undeniable that marine species suffer from pressure and stress of environmental conditions as well as from changes in climate, both of which contribute to the expansion or contraction of their populations, or their annual variability. We do not have the same number of individuals in the same area every year, since there are seasonal, annual, cyclical-multiannual, and unpredictable variations. The contamination and destruction of habitats are harmful processes for the natural conditions of fish stocks. In insular and tropical ecosystems, the effects of such anthropogenic processes on fish are devastating.

[10] A bioregion is an extensive geographical area that shares species, habitats, and physical characteristics. Biomes are large geographical regions on the planet characterized by a general type of environment; examples include: tropical forests, tundras, and deserts, among others.



However, very little has been done to integrate the notion of ecosystems into the management of fisheries and to incorporate the human dimension (social, economic, and cultural) and the natural dimension (biological, physical, and chemical), as mandated by the Magnuson-Stevens Law of 1996 in the United States.

Grouper Fishing in Puerto Rico

by Michelle T. Schärer Umpierre

Some of the impacts of fishing activities on the resources of Puerto Rico can be observed in the current condition of a number of species of commercial interest. The most prominent case is that of the grouper, considered a first-rate fish in the markets and the tables of consumers. One of the most important species was the Nassau grouper (the native grouper), *Epinephelus striatus*, which was abundant off our coasts and in our fish markets. From 1950 to 1980, the Nassau grouper was the primary species of grouper landings in Puerto Rico, in terms of pounds as well as quantity. The Nassau grouper, in the 1970s, was the species with the fourth largest number of landings. Close to fifteen years later, in 1986, it was considered to be commercially extinct, since its landings were a minimum fraction of the total of local landings. Finally, in 1996, the Nassau grouper was placed on the Red List (of threatened species) of the International Union for the Conservation of Nature and Natural Resources, due to the shortage in its populations throughout the Caribbean.

Many open-sea fishermen, who traveled for weeks searching for silk snappers and deep-sea groupers, were also dedicated to grouper fishing in the shallower waters of coral reefs. Several of the larger landings of Nassau groupers were carried out between the months of December and February, due to the fishing of this species during its spawning aggregation. The spawning aggregations

of groupers and snappers form once a year. During this period, all adult individuals congregate to release eggs and sperm in the water column on certain nights. The disadvantage for the groupers is that they always return to the same spot, year after year, and they do not leave until the spawning period is over, a fact that fishermen also learned.

Why don't we see the Nassau grouper in current landings? This is primarily due to the prohibition placed on the fishing of this species, since 1991, in the United States Caribbean under the Fisheries Management Plan of the CFMC and, recently, in the fishing regulations of Puerto Rico. These regulations were established due to the decline in the population of the Nassau grouper and the Goliath grouper (*Epinephelus itajara*) throughout the Puerto Rican archipelago. It is deduced that the fishing of the Nassau grouper during its spawning period caused the eradication of the individuals of reproductive age from the population, which in turn affected the probability of engendering subsequent generations. Unfortunately, in Puerto Rico, the populations have not recuperated and the remaining aggregations continue to be exploited by some fishermen who do not respect the established fishing season. Furthermore, the populations of Nassau groupers confront another obstacle: the juvenile individuals depend on habitats in shallow coastal waters for feeding and survival during the early stages of their development. It is precisely in these areas that the impact of pollution, sedimentation, and the destruction of habitats is most significant. For the recovery of this species, we are going to have to look for seeds in other islands where there are still healthy aggregations and protect the places in Puerto Rico where at least some groupers can be found, in order to give them an opportunity to reproduce again.

Puerto Rican Lobster Case Study

by Michelle T. Schärer-Umpierre

Lobsters, of the species *Panulirus argus*, have been commercially captured in Puerto Rico since the 1950s. The most common methods for the capture of this species are: boxes, fish traps, nets (*filetes*), and diving, which is currently the most common. Even though there is a considerable increase between the months of December and March, probably associated with the migration of lobsters during the period of northern swells, they are captured at different depths throughout the insular platform, all year long.

The annual average of lobster landings on the Island has been 220,783.5 pounds over the past 25 years. In 1951, the reported amount was 446,000 pounds; in 1991, the reported amount was 221,588 pounds, and, more recently, 167,276 pounds in 2008 (refer to the graph). In the local market, the product's prices have increased significantly over the past decades, for example from $4.50 to $9.00 a pound, even though this varies depending on demand. The reduction in landing rates (for example, pounds per day/per fish trap), the total landings (with an equivalent effort), and the relative abundance of these organisms suggest a possibility that this fishery is being over-fished. However, it is recognized that there is a need for research in order to determine the current condition of the resource.

Small lobsters reach shallow territory through sea currents, close to the coasts, in order to settle down. The juveniles, which will form part of future landings, mature in habitats located in seagrass meadows and other adjacent areas. Therefore, shallow marine habitats, close to the coast, should be considered essential for a healthy fishery. The effect of the loss of marine pastures, sedimentation (produced by the impact of construction, deforestation, and erosion), and pollution on the survival rates of juvenile lobsters is unknown. Moreover, a virus has been detected (PaV1) that is killing juvenile lobsters in Florida, although it is still unknown whether this pathogen is present on our coasts.

In 1985, lobster fishing became regulated by the CFMC through their Fisheries Management Plan (FMP), which applies to Puerto Rico and the US Virgin Islands, and by the Department of Natural and Environmental Resources (DNER) through their Fishing Regulations. Some of the regulations that aim to maintain the resource's health, and thereby protect the future of this fishery, include:

- a minimum landing size of 3.5 inches (89mm) in carapace length;

the lobster is to be captured alive and not dismembered;

the capture of females with hard roes is prohibited;

the use of chemicals or explosives for their capture is prohibited; and

the use of boathooks or harpoons that may harm the lobster is prohibited; only lassos may be used as a method of capture.

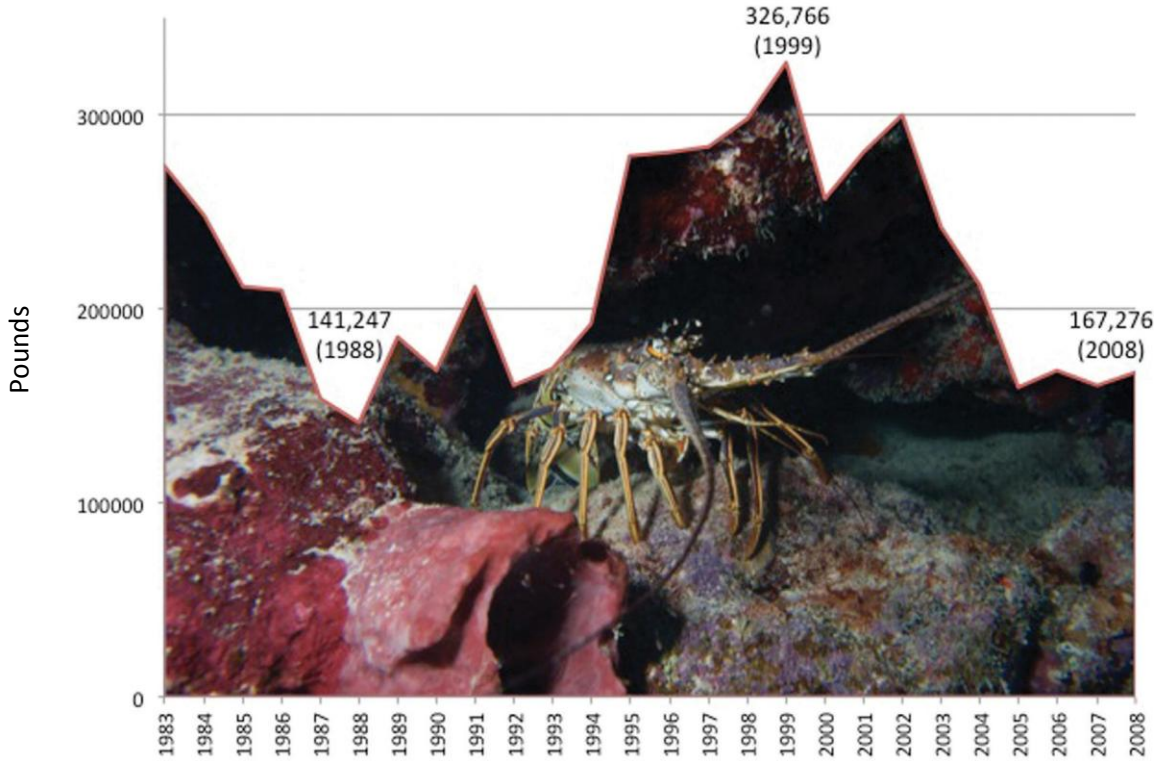
At the beginning of the 1990s, it was observed that approximately 40% of landed lobsters measured less than the minimum legal size (3.5 inches), which suggests a high rate of non-compliance with the law. In 1998, it was estimated that 24% of landings were of individuals below the permitted size. It is probable that the tendency to land individuals of an inappropriate size was reduced due to two factors: (1) many fishermen correctly understood the benefit (for them and for the resources) of capturing lobsters of the correct size, and (2) the intervention of public agents that discouraged fishermen who broke the law. It has been stated that the fishing of individuals below the legal size can put this resource at risk and requires better supervision for commercial and recreational fishing of lobster in order to guarantee sustainable fishing.

Having bigger lobsters in our archipelago can provide an advantage to our lobster fisheries over other areas. A population with numerous larger individuals has a greater capacity for survival against environmental changes, and is thus better able to conserve its reproductive capacity and provide larvae and juveniles to the neighboring areas. Interestingly, in Puerto Rico, a fishing season for lobster has not been established, a strategy that is used in other Caribbean jurisdictions during the months of March and June. A lobster's size may be a way to guarantee that it will be able to reproduce successfully, at least once, before being captured. However, in order to find out what is happening with this fishery, it would be useful to conduct Island-wide research with the help of fishermen. We would then be able to determine which measurements are necessary for the continuation of sustainable lobster fishing in Puerto Rico.

Some fishermen claim to know that they are prohibited from fishing individuals smaller than 3.5 inches; meanwhile, in supermarkets smaller lobster tails are being sold. The truth is that many of those lobsters are imported from other countries where the regulations are different and there is very little vigilance over the shipments that enter the Island. To limit the entry into Puerto Rico and the US Virgin Islands of lobsters that measure less than the legal size permitted in the US Caribbean (3.5 inches), a federal ban was established (Amendment 4 of the FMP, January 2009) on the importation of lobster tails that weigh less than 6 ounces (170 grams). The weight of 6 ounces is equivalent to the tail of a lobster that measures 6.2 inches, which would belong to a lobster with a carapace length of 3.5

inches, though this may vary. The idea is for this regulation to protect local product against the importation of lobster from other countries, in such a way that the market price is not affected. Therefore, the sale of a lobster tail that is less than 6 ounces in Puerto Rico can be reported and, eventually, fined by federal agencies.

To improve the price of lobster on the market, some towns have organized themselves in order to request a certification (blue label or eco-labeling) that will guarantee that the product comes from a fishery with management that assures the sustainability of the resource. This provides an advantage to local and international markets, where consumers choose to invest in the product due to the assurance of quality and sustainability. Examples of this are the lobsters that are raised in 'casitas cubanas' (structures that serve as hideouts for lobsters), within sections of sea that are shared by members of the fishing cooperatives off the coast of Yucatán, México. In the bay of Sian Ka'an and in Banco Chinchorro, lobsters are captured by hand without diving gear, harpoons, or boathooks, which permits the release of those individuals that are below legal size or that have hard roes. This certification evaluates three principles of the fishery: (1) it must guarantee a sustainable stock; (2) the impact on the ecosystem must be minimal; and (3) its management must be supported by a system of governance and clear public policies that will guarantee vigilance, the fulfillment of the law, and a responsible decision-making process.




YAMAHA

The Fisheries of Puerto Rico

What are the characteristics of Puerto Rican fisheries? What distinguishes them from others? The data presented below contributes to a general perception about fishing in Puerto Rico:

The commercial production of fishing has been approximately 3.5 million pounds per year. The seasons of 1978 to 1982 were the most productive, because the Cabo Rojo fleet ventured into the fishing waters of the Mona Passage, Cabo Engaño, and La Navidad (Dominican Republic), of the Saba Islands, of the island of San Bartolomé, and into others of the Lesser Antilles. This caused the volume of landings to increase in fishing statistics. In 1932, fishing in Puerto Rico reached 3.5 million pounds. From 1969 to 2001, it averaged 3.8 million pounds per year. The data available between 1995 and 2001 indicates that the annual quantity of landings oscillates between 3.3 and 2.86 million pounds. Apparently, there has not been much variation in the past 60 years.

The number of fishers with licenses or fishers included in the census has historically oscillated between 1,500 and 2,000, a consistent number in various censuses since 1803. This number fluctuates due to the development of other sectors of the economy, such as the construction sector, which attracts fishermen for short periods of time. It also correlates to short-term circular migration, specifically traveling to the United States and working for a season. Daniel Matos Caraballo, a specialist in fishing statistics from the DNER's Fisheries Research Laboratory, and Juan Agar Donald from the United States' National Marine Fisheries Service, have recently reported (2010) in their summary of the last fishers census, that the number of fishermen has collapsed, probably because the stocks were not big enough to support so many fishermen or because some fishermen moved to other sectors of the economy. Investigators also suggest that fishing seasons, regulations, and the requisites for income evidence necessary to obtain a fishing license dissuaded many fishermen from remaining in the fishing sector, or as many have said, "they took me out of fishing."[11]

[11] It was expected that the number of fishermen would increase in the last four years, due to the reduction of the economy, but mostly due to the immobility of the construction sector. However, this has not occurred; the number of fishermen has diminished. Fishing agents have reported that many have left for the United States while others have joined the construction sector, something that must be analyzed more thoroughly. There exists an undetermined number of fishermen that have not been registered and that operate "under the radar" of the authorities, since they wish to evade them and not be part of the statistics.

The last fishermen census (2008) indicated that there were 868 fishermen. It should be emphasized that the number of fishermen who were interviewed in that census is less than the 1,129 who were registered with the Department of Natural and Environmental Resources (DNER). This may be due to the fact that many fishermen with licenses fish only occasionally and are not active all year long.

Fishing activities are limited to the insular platform and to external banks. The essential fishing gear has traditionally been: fish traps, hand-dragged nets such as the *mallorquines* and the trammel, lines for bottom fishing, and fishing poles. Many vessels have undergone modifications and there is great diversity in their form and function. The fleet is equipped with outboard motors and it is mostly composed of small vessels (15 – 20 feet in length) that are fast and relatively comfortable for shallow waters near ports. These vessels can also be equipped with one or two electric winches that are used on the shelf edge or in deep fishing banks to capture silk snappers and queen snappers. These vessels have global positioning system (GPS) equipment and depth sensors that allow them to better identify fishing areas. Fishing with diving equipment (SCUBA) was popularized in1982. Since then, it has become an important technique for the fishing of queen snapper, lobsters, squid, and reef fish. In 2002, diving surpassed fish traps, in terms of fisheries' production. This is, without a doubt, one of the most dramatic changes in the efforts of our fisheries.

The competition between divers and fish trap users caused many to reduce their fishing gear or the number of their traps and to start using trammel nets and *mallorquines*. Another factor that influenced the reduction in the usage of fish traps is the loss of fishing gear due to the cutting of buoys by other vessels and the force of hurricanes, as well as the high price of the materials necessary to construct them. Since 1985, nets have become an important type of fishing gear.

The intake of fish has been tied to foreign import since the Spanish colonial period. This has remained constant through every period of our history. Before trying to develop a fishing industry, Puerto Ricans entered the Spanish cycle of the codfish market, which was eventually supplied by England (through their possessions in Canada, such as Newfoundland and Nova Scotia), the United States, Norway, Spain, Portugal, and Canada.

Support and Development of Puerto Rican Fisheries

Has there been a balance in the efforts for the development of fishing? Were all the necessary actions taken? It all depends from which perspective you look at it. For many, much was done, due to the economic circumstances of the Island and the quantity of resources available in our waters. For others, the answer was no; not enough has been done, since all the effort was focused on particular activities without consolidating different development programs.

In *The State and Small Scale Fisheries in Puerto Rico* (2005), an exceptional work on the development of fishing, Puerto Rican anthropologist Ricardo Pérez reports that the development of fishing has been dominated by small efforts, by a certain lack of integration and collaboration between agencies, and by the absence of funds to increase the technological capacity of fishermen. In the 1930s, governmental efforts were anchored in an agrarian reform that sought better distribution of land and resolution to the social problems that were created by the division of land into a few large estates, such as extreme poverty and a population of laborers without land. These were the years of the post-Great-Depression predicament, with the reconstruction of Puerto Rico via the Puerto Rico Emergency Relief Administration (PRERA) and the Puerto Rico Reconstruction Administration (PRRA), a process that, according to economist James Dietz,

in reality dealt with the construction of a modern and industrialized Puerto Rico.

However, in the 1940s, the government invested greater effort in local fisheries, with the creation of a laboratory for the study of fishing. This laboratory started in 1941 with an aggressive program to increase the efficiency of fishing statistics, which are, to a certain extent, the stronghold of knowledge about stocks and the efforts undertaken. Perhaps of greater interest is the fact that the laboratory initiated a program for oceanographic exploration in order to better examine the possibility of developing a fishing fleet. In 1945, the Puerto Rico Agricultural Corporation (PRACO) continued with the exploration and sent a tuna clipper that made various trips to the Great Banks of Newfoundland to evaluate the possibility of such long-distance fishing. This effort deserves a separate commentary, since Puerto Rico had a nutritional obsession with codfish. The numbers are impressive and, during the first half of the twentieth century, our country was one of the leading consumers of codfish, as well as one of the preferred clients of the exporters associated with the Newfoundland Fisheries Board. The government's goal was to replace with fresh fish the importation of 30 million pounds of codfish per year from 1930 – 1945. Several small crises, related to the quality of the codfish and its availability during the Second World War, ensured that the governors of Puerto Rico would worry about the constant availability of codfish in Puerto Rican households. This exploration project failed due to its poor design and high expectations, and because it was not executed in conjunction with a coherent exploration, research, subvention, and development program. It also represented an

enormous leap for many Puerto Rican fishermen, who were dedicated to daily fishing off the coast.

To embark on an enterprise of great scope, you have to capacitate yourself, learn, and take risks. That is to say, the focus of this effort was correct—heading out to sea and into other jurisdictions to fish—but it was not supported with the funds or the managerial culture that could comprehend the type of fishing it demanded. Perhaps there are those that believe that we lack the seafaring culture to face such a challenge. In Puerto Rico, contrary to what some colleagues believe, there has existed a seafaring tradition throughout our history, though it has been hidden or circumvented. The case of Puerto Real in Cabo Rojo and other communities in the western area have been evidence of this. However, it has certainly not been the norm in Puerto Rico. A comparison of the situation in Cuba to that in Puerto Rico—regardless of the disparities in size, availability, and proximity of fishing stocks—helps put our own history into perspective.

At the end of its revolution, in 1959, Cuba did the same thing that Puerto Rico had done during the 1940s: it changed its focus to deep-sea fishing. However, its efforts were supported by the establishment of a fishing institute, dedicated to capacitating workers for the fishing fleet and the merchant marine, the purchase of vessels and equipment, the creation of the Fisheries Research Center (CIP, its acronym in Spanish), the development of a concerted plan for fishing exploration, and the support of the Soviet Union, which at that time was one of the most important fishing powerhouses in the world.

At that time, even though its tuna fishing efforts were impressive, the United States' incipient fishing industry still lacked a widespread plan to financially encourage it. After these explorations—specifically in Cuba, the Mona Passage (Puerto Rico), and the Bahamas—the Puerto Rican government abandoned this effort in order to dedicate itself to the creation of a fresh fish market and to increase the technological level of artisanal fishermen (i.e. those that build their own vessels and fishing gear).

For Ricardo Pérez, the development of fishing during the 1940s presented an erratic and even unwise movement. The elimination of PRACO put a stop to the dream of having a Puerto Rican fishing fleet, and the government never recovered its enthusiasm or vision for creating a fishing industry. The lack of recurrent funds to promote fishing, alongside the absence of private capital interested in investing, was the fatal wound that put an end to this dream. Since this moment, efforts to promote fishing have been limited to

improving the installations that were already appointed for this activity, dispensing loans, expediting the flow of merchandise, and obtaining better vessels. In essence, the actions that have been taken to develop fishing in Puerto Rico can be summarized as follows:

the creation of exploration programs to identify fishing resources;

the transformation of the fishing fleet: from sails to gas-powered vessels (in native ships, sloops);

the motorization of small fishing boats (with outboard motors), the usage of different types of vessels, and the mechanization of all onboard operations (winches);

the dispensing of loans to fishermen—via the Credit Program—with the intention of helping them obtain motors, vessels, and fishing gear;

the construction and remodeling of fishing villages, of storage areas for the fishermen, and of areas to process and sell fish;

the development of programs to improve the conditions in fishing villages, to promote fish marketing and the hygienic handling of food, and to purchase refrigerators;

the creation of programs for the purchase of vessels for commercial fishing under the auspice of the Community Action Program (with federal funds);

the centralization of the governmental activity for the development of fishing through the Corporation for the Development and Administration of Marine, Lacustrine, and Fluvial Resources of Puerto Rico or CODREMAR (Corporación para el Desarrollo de los Recursos Marinos, Lacustres y Fluviales)[12] and;

the development of fishermen's associations (an alternative to the failed attempts at cooperatives and fishing businesses) as a form of organization and to offer governmental services.

To summarize, there have been small but significant efforts to help fishermen acquire better technology and working conditions, and to lessen their dependency on monopolies. However, these efforts started to decrease in the 1980s, during the administration of President Ronald Reagan (1982-1988), due to a gradual reduction in the funds available for fishing development programs and the inability of these programs to adapt to Puerto Rico. To elucidate, our country has always depended on federal funds in order to keep its fishing industry viable. Unfortunately, these funds are no longer available.

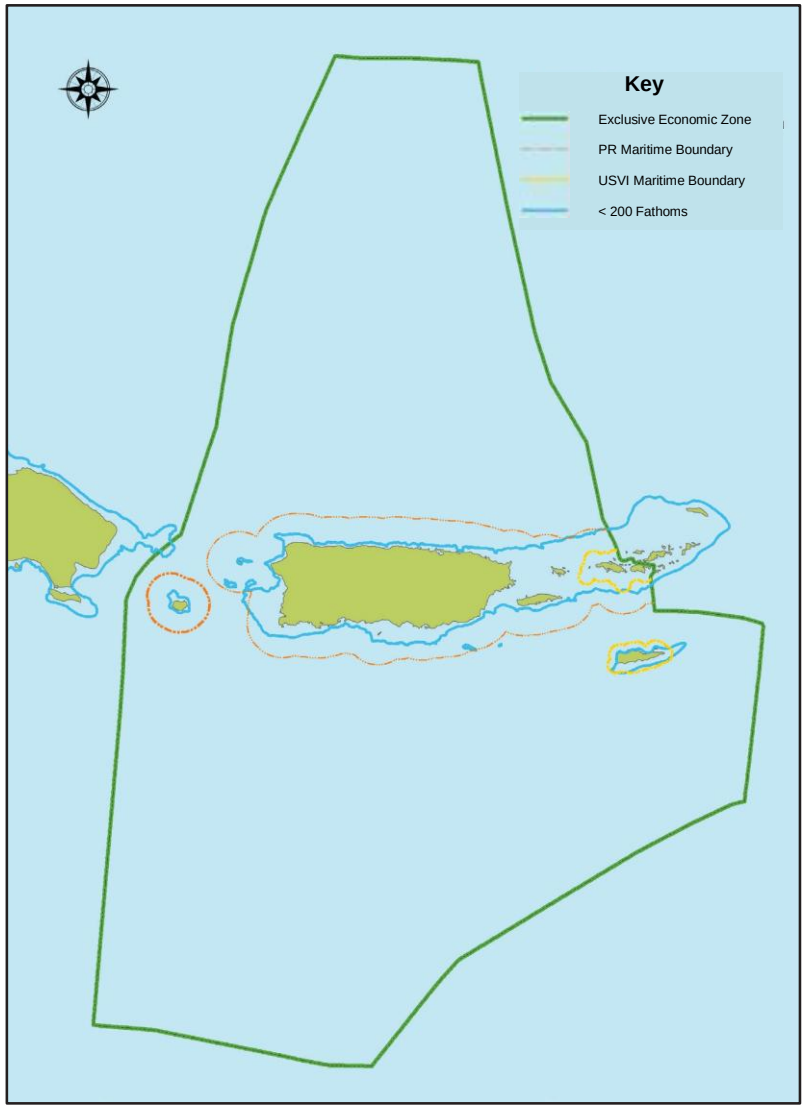
[12] This has been one of the most significant governmental efforts, whose history and impact is yet to be observed.

Development in Other Parts of the World

Many people might ask themselves why Puerto Rico never developed its own fishing fleet, like other nations did. This is a question with multiple answers from various points of view. Firstly, Puerto Rico wagered on modernization through manufacturing. The goal was to become an industrialized country, with salaried employment and an elevated standard of living. The fostering of these activities required the undivided effort of the political leaders and technocrats in charge of designing the new Puerto Rico. For this reason, fishing was relegated—and remains so, in administrative terms—to the Department of Agriculture of the Commonwealth of Puerto Rico. Sure enough, agriculture became less significant and faded into the background as the country became industrialized and urbanized. There was

neither time, funds, nor even interest in dedicating joint efforts to any other activity; though fishing never ceased being of interest to our leaders, who always believed that there were other resources to be utilized in our waters, such as squid and various pelagic fish: tuna, swordfish, and wahoos, among others.

It is important explore how other countries have approached their fishing industries, to carefully examine the requisites that are imposed on the development of fishing fleets, with an industrialized model of this sector. Some promoters of public policy, as well as some citizens, believe that the development of fishing is something that can be initiated with a small government-commissioned study and subsidized with a couple hundred thousand—or perhaps a couple million—dollars; nothing, however, is further from the truth. The development of fishing requires an enormous effort and commitment from both the government and the private sector, long- and short-term planning, scientific research, and technological and engineering development, as well as the expenditure of millions of dollars. The following are the central elements that have historically been required for such an undertaking:



This development starts in countries with vast fishing resources that are capable of sustaining an increase in fishing efforts.

The countries that are committed to the development of fishing promote it because they are aware of the existence of fishing stocks that have allowed a continuous fishing effort. These stocks and their utilization have stimulated the investment of private capital in order to take advantage of the economic prosperity that permits the sale of these stocks in local, national, and global markets. The abundance of resources is similar to collateral for a bank loan. The government provides the money for the development of the sector because it knows that its investment will be backed by the promise of large landings.

The capacity and sovereignty to establish agreements with other countries and with worldwide regulatory organizations

Countries that have successfully developed their fishing industry are, for the most part, sovereign nations that made this decision as part of their strategies to substitute imported goods, to acquire valuta (hard currency), and to continue in their chosen route. A sovereign nation is permitted to establish agreements with and to fish in the waters of other countries. It can be observed that before the United Nations Convention on the Law of the Sea (UNCLOS) established 200 miles as an Exclusive Economic Zone (EEZ) for each country, the fleets of powerful fisheries ventured into foreign waters to take advantage of other countries' resources. This happened with the French and the Spanish, who fished in Canadian waters, and with the United States, who followed tuna shoals along the Mexican coastline.

For many years, Cuba fished in the Gulf of Campeche, in Mexico, one of its most significant fisheries: the red grouper (*Epinephelus morio*). The Japanese, the Soviets, and the Portuguese crossed the ocean many times to fish in the waters of the United States, Canada, Chile, and Peru, among other countries. In 1982, UNCLOS definitively changed this situation by establishing 200 miles of territorial waters for each sovereign nation. Since then, fleets that wish to fish in foreign waters are required to petition and pay for permits, adjust to landing quotas, and follow the rules imposed by the host nations in possession of these 200 miles. These transactions are only possible through corporations or governmental offices.

The State Department of the Commonwealth of Puerto Rico, or ELA (Estado Libre Asociado), cannot enter into fishing agreements with other countries, either to fish in their waters or to allow them to fish in the 200 miles of Puerto Rico's EEZ, since these waters

are under the jurisdiction of the United States.[13] In this manner, the ELA is subject to the rules and conditions that are imposed by the National Marine Fisheries Service (NMFS)-NOAA.

Sovereign countries with an abundance of resources can obtain income by selling fishing permits to foreign nations, or they can establish economic agreements with them, allowing the fishing fleet of said nation to utilize the sovereign country's resources. For example, the United States has enjoyed income derived from its fishing resources through permits issued to foreign nations.

The status of being a sovereign country allows for the establishment of policies to protect national fisheries and to maintain a competitive and stable structure of prices. The international community does not tolerate protectionism, yet countries establish, on an individual basis, strategies that will favor local products, against the competition (often times disloyal) of foreign products that affect local production.[14]

The status of being a sovereign nation is also used as a tool in international disputes over fishing stocks and the right to fish in international waters. Sovereign nations, which also participate in regional or continental agencies, serve as a support system for nations involved in conflicts that may be close to military aggression or war. This is what happened between Spain and Canada, during the 1990s, in the conflict known as the Turbot War. It is inevitable; politics form an integral part of the debate over fish stocks and their future.

Investment in fishing technology to venture beyond the platform in order engage in deep-sea fishing or to fish in international waters

Once a commitment toward the development of fishing is made, the first thing that has to be done is to transfer information and capital to the fishing sector in order to increase the production

[13] The Exclusive Economic Zone (EEZ) is an area of the sea, the ocean, or a continental or insular platform that a government claims for its own use and establishes as part of its territory. According to international agreements, the EEZ is constituted by two hundred miles, where the government carries out the utilization of its resources. The EEZ of Puerto Rico is under the jurisdiction of the United States. For more information on the EEZ, refer to the *Fuete y Verguilla* magazine, Volume 3, Number 4 (November 2009), which offers a report on several aspects of this topic. The magazine can be downloaded through the University of Puerto Rico Sea Grant College Program's Internet page: http://www.seagrantpr.org/catalog/files/fuete/vol3num4.pdf . This publication is available only in Spanish.

[14] This publication, including this section, was written in 2005 and subsequently revised in 2007 and 2008. The argument that is presented here has not been altered from its original version; for this reason it is not in any way related to the debates concerning national sovereignty that were elaborated in May of 2008.

capacity of the fleet. It is necessary to develop vessels, navigators, sailors, technicians, fishing gear, an infrastructure for the processing and distribution of fish, and product marketing. Training schools for sailing and fishing, as well as fishing institutes, are essential. By recruiting naval architects and engineers, shipyards and dry docks can be constructed, and port installations are established to house the fishing fleets and participating companies. The fleets are designed and constructed after careful planning, taking into account the nature of the resource, the habitats that are to be utilized, and the distances that need to be covered.

Programs for the study of fishing stocks with new fishing techniques for the exploration of fishing banks and resources

Oceanographic research is financially encouraged and supported in order to provide the necessary knowledge that will optimize fishing efforts. For example, various countries develop oceanographic institutes that research the weather, the currents, the nutrients in the ocean, the ecosystems, the ocean floor, fish species and populations, and stocks. The best technology in remote sensing, with satellite technology, used to trace the routes of fishing vessels. Meanwhile, thermal imaging and nutrients help to locate the routes frequented by shoals of migratory species, for example: tuna fish.

These institutes developed exploration programs in order to identify fish populations and new stocks that could be utilized by fishing fleets. The volumes of landings in a particular region are known through counting systems, called fishing statistics. Alongside this measure, continuous and systematic observation (monitoring) programs are established that oversee the condition or status of fish populations. Fishing stocks are a valuable marine resource and they represent a renewable inflow into the economy; as long as adequate time is allotted for reproduction and for the protection of the physical environments that serve as areas for spawning, fish hatcheries, dwellings, feeding zones, shelters, and transit space. Fishing techniques are the product of the best engineering and design that can be offered by the country's technicians: electric systems, hydraulic systems, mechanisms to launch and retrieve nets, electronic devices, refrigeration systems, and communication systems are only a sample of the new technology that is necessary to improve fishing production.

Apart from oceanographic studies, the government endorses and subsidizes, together with private capital that benefits from the resource, studies and programs for marketing, sustainability, and protection of the

product. New fishing stocks are the focus of scientific strategies that seek to promote the new product through publicity and innovative gastronomic projects in restaurants and supermarkets. In collaboration with these efforts, the countries that are committed to the development of fishing, along with private capital investors, invest in food centers or institutes that experiment with the raw material, in this case fish, for the preparation of new products derived from this resource. Value is added in the processing and packaging of the raw material, in order to manufacture a new product. This is the history of canned tuna, tuna packaged in packets, fish sticks, frozen fish fillets, and ***surimi***[15] which is sold as "crab meat."

Legislation

The development of the fishing sector requires the creation, implementation, and execution of legislative programs that will protect the resources (populations, stocks), the ecosystems, the producers, the investors, and the consumers. The government encourages legislation that protects the industry and all of those involved in the fisheries. This legislation is produced by taking into consideration the wellbeing of the nation (in its entirety) and that of the fisheries. An example of this—with all its defects and virtues—can be seen in the Magnuson-Stevens Fishery Conservation and Management Act of the United States of America. The FMP, overseen by the CFMC in this region of the United States, presents an example of action and planning focused on the conservation of stocks. By law, the FMP has to consider the wellbeing of the fishing communities, the markets, and the nation in order to be approved. However, these plans lack concrete data on the landings in the recreational-sport sector, which is estimated to extract equal or greater biomass volume from the sea as commercial fishermen. NOAA and the Department of Natural and Environmental Resources (DNER) work fervently with registration and licensing systems for recreational fishermen, which will be beneficial in understanding the current status of fish landings, and for the management and conservation of resources.

[15] *Surimi* is a product that is derived from the meat of various fish, including the Atlantic menhaden (*Brevoortia tyrannus*). This fish is processed and kneaded, and glucose is added, along with other products, for flavoring, to turn it into a malleable paste that is available in the market in different forms.

Monetary Incentives

We have no arrived at one of the thorniest issues related to the development of fishing: the investment of capital, the subsidies to the fishing sector, and the transference of funds. Through a quick glance over the events that have transpired in various countries, we notice that fishing can only be sustained through the support of constant expenditure of government funds. Why is this so? Fishing is a high-risk activity for the property and the life of the participants due to the dangerous nature of working in the high seas, or even in coastal waters. This is also a high-risk activity in economic terms. The yield from these efforts is not always constant, and for this reason, the financial sector hesitates to lend money for these purposes. The variability of the resource, itself, generates uncertainty regarding the uninterrupted production of income. In other words, there is no certainty that fishing will be good all the time or that captures will be successful, so it is probable that fishermen will not be able to pay their loans. Worse still, fishing gear and vessels are lost at high-sea due to bad weather or accidents. This high-risk context limits the availability of additional capital to invest in the production and sale of fish. The market is one of the areas where most of the income is produced, apart from the private capital that is invested in fisheries. Most private fishing fleets around the world are the product of the investment of capital that is produced in the distribution of merchandise.

In the presence of this shortage of funds for the development of fishing, governments invest money from the proceeds derived from permits and taxes to promote this economic activity, to help small and medium-sized producers and entrepreneurs, to provide monetary assistance during catastrophes and emergencies, to dispense loans with low interest rates, and to bestow tax waivers to increase the investment of capital in the industry. It is estimated that around the world, the value of these waivers is equivalent to 25% of the commercial value of $56 billion on a global scale. In other words, governments develop and implement programs to sustain fishermen, to help shipbuilders avoid bankruptcy, and to protect merchants in times of crisis.

Is the United States a good example to emulate in the development of fishing?

The United States is one of the countries that has committed the most effort toward the development of fishing. Its trajectory has been discussed in important books, many of them recent publications, that which
the path of a state aggressive in the protection of the resource and of the individual and corporate

capital that moves fishing. The book *From Abundance to Scarcity*: *A History of U.S. Marine Fisheries Policy* by Michael L. Weber (2001), specialist in fisheries and public policy, is an example of this. This development is not necessarily the product of an articulated plan, outlined step by step, but the product of institutional, legislative, state, federal, corporate, and labor union efforts in a race on an unclear path, but with the clear goal of increasing the quantity of landings as well as personal, corporate, and governmental incomes, a product of the vast fishing resources of this country.

In this work, I present for your consideration an outline of the different milestones or relevant points of such an undertaking that demonstrate the commitment to the development of fishing.

The economic investments and scientific efforts are concentrated in the exploration and research of new stocks, for example: Alaskan king crab, perch, red shrimp, yellowfin tuna, and Pacific pollock.

The promulgation of the Saltonstall-Kennedy Law in 1954, which required a governmental investment of 30% of the customs revenues collected from fishing products for research and for the market, has been vital for the development of new fishing gear and the gastronomic promotion of new species.

The conferment of government loans was promoted for the purchasing of vessels in order to compete with foreign fleets that were fishing the same resource in waters of the United States, as was the case with tuna fishing fleets that used surrounding nets.

The subsidy plan that started in 1960, to cover 30% of the construction costs of one vessel, if it was constructed in the United States, triggered production activities in the shipyards of this nation, which favored the investment of capital for new vessels. Thus began the intensive renovation of the fishing fleet in the 1970s.

The Magnuson-Stevens Act of 1976 was established with the intent to protect marine species and to manage, in an appropriate and rational manner, the country's fisheries. Through the intervention of the NMFS and the creation of Regional Fisheries Management Councils, a mechanism for conservation was created, based on the participation of fishermen, of those with an interest in the topic,

of governmental officers, and of the scientific community in the elaboration and implementation of targeted management plans for the prevention of overfishing, the management of the resources for the wellbeing of the nation, and the maintenance of sustainable fishing activity. The Magnuson-Stevens Act regulated the extraction of marine resources within the federal jurisdiction (from 3 to 200 miles, in the majority of the states). This law was also established for the purpose of eliminating foreign fishing from the waters of the United States and to favor the participation of fishermen from the United States. In this sense, the law was successful during the first decade of its implementation, as evidenced by the following: (a) the number of foreign vessels that fished in its waters was reduced; (b) between 1976 and 1983, the number of large vessels increased by 70%, while the number of small vessels decreased by 40%; (c) approximately 13,349 vessels were constructed, the greatest effort in the construction of fishing vessels in the country's history, and; (d) fishing production increased from 2.6 million metric tons—the approximate average since the Second World War—to 4.3 million.

The management and efforts put forth by these strategies that articulated the EEZ triggered the expansion of national production in these waters and displaced foreign fleets that fished in them.

The capital fund for the construction of vessels allowed for development as it exempted fishermen from paying taxes on any income that was invested in the construction of vessels. That is to say, the government stimulated individual investment in the fishing technology development process.

The establishment of government-endorsed loans for the purpose of purchasing fishing vessels; between 1976 and 1995, 1,250 loans were granted for a total value of $728 million.

In the 1960s, Americans not only moved rapidly in the space race due to Soviet pressure, they also moved in a desperate race to surpass the Soviet Union and Japan as a fishing powerhouse. The steps taken were many and, it would seem, well chosen. The Magnuson-Stevens Act, as the pivotal point of the development strategy, allowed for an increase in the production capacity of American fishermen, while simultaneously decreasing the efforts of foreign fleets. The development of this law is, without a doubt, an example of a country's commitment to the development of fishing.

The harmful effects of this development

The enthusiasm for the development of fishing is commendable, because it has had an impressive socioeconomic impact in the countries where it has taken place. The most significant impacts of this development include: an increase in per capita income among this sector's participants (for example, American fishermen multiplied their income by 2.5 since the Magnuson-Stevens Act), an staggering number of technological improvements, an increase in the quality of life, a sustained increase in landings over a long period, and an increase in the profits of fishing firms. However, this development has had, in the long run, a harmful impact on this sector of the economy and on some resources and stocks.[16] I invite you to look again at the United States, which is a close example

[16] Due to a dearth of precise data, I will not discuss here the impact of this growth on fish processing and packaging companies (e.g., tuna), supermarket chains, and restaurants, which add value to fish products and represent another mode to move merchandise.

to follow. Some of the most notable characteristics of fishing development in the United States are:

An increase in large vessels by a factor of five.

The efforts were duplicated; therefore, the pressure on stocks and fish populations increased.

A disproportionate increase in the number of vessels in some fisheries; for example, in shrimp fishing in the Gulf of Mexico, the number of ships increased in such a manner that fishing was no longer profitable for all participants. As a result, many abandoned fishing.

The production of fish in the United States consistently increased until 1995. Since then, it has remained static.

Over-capitalization. The programs, incentives, loans, and subsidies helped fishermen to purchase the best vessels and fishing gear available on the market. To locate fish, they employed state-of-the-art electronic gadgets to measure depth, temperatures, and fish banks, and they acquired the best meteorological information and satellite images with information on the ocean. This level of production capacity required the investment of a considerable amount of capital. The United States' fisheries have reached what fishing economists have termed "over-capitalization," which is when the capacity for fishing, harvesting, or processing fish is higher than what the stocks can sustain. In the context of fishing, there are more and better vessels and equipment than what can be sustained by fish landings. Therefore, producers tend to race uncontrollably to capture more than their competitors in order to, in economic terms, make this activity viable. The fishermen who cannot compete have to leave the sector or get rid of their ships and equipment. It is estimated that the American fleet is in a process of over-capitalization and that many of its stocks have been over-fished. This situation imposes high costs on the process of fishing and threatens the collapse of the resource altogether, as well as puts the communities that depend on fishing at risk of losing their form and culture.

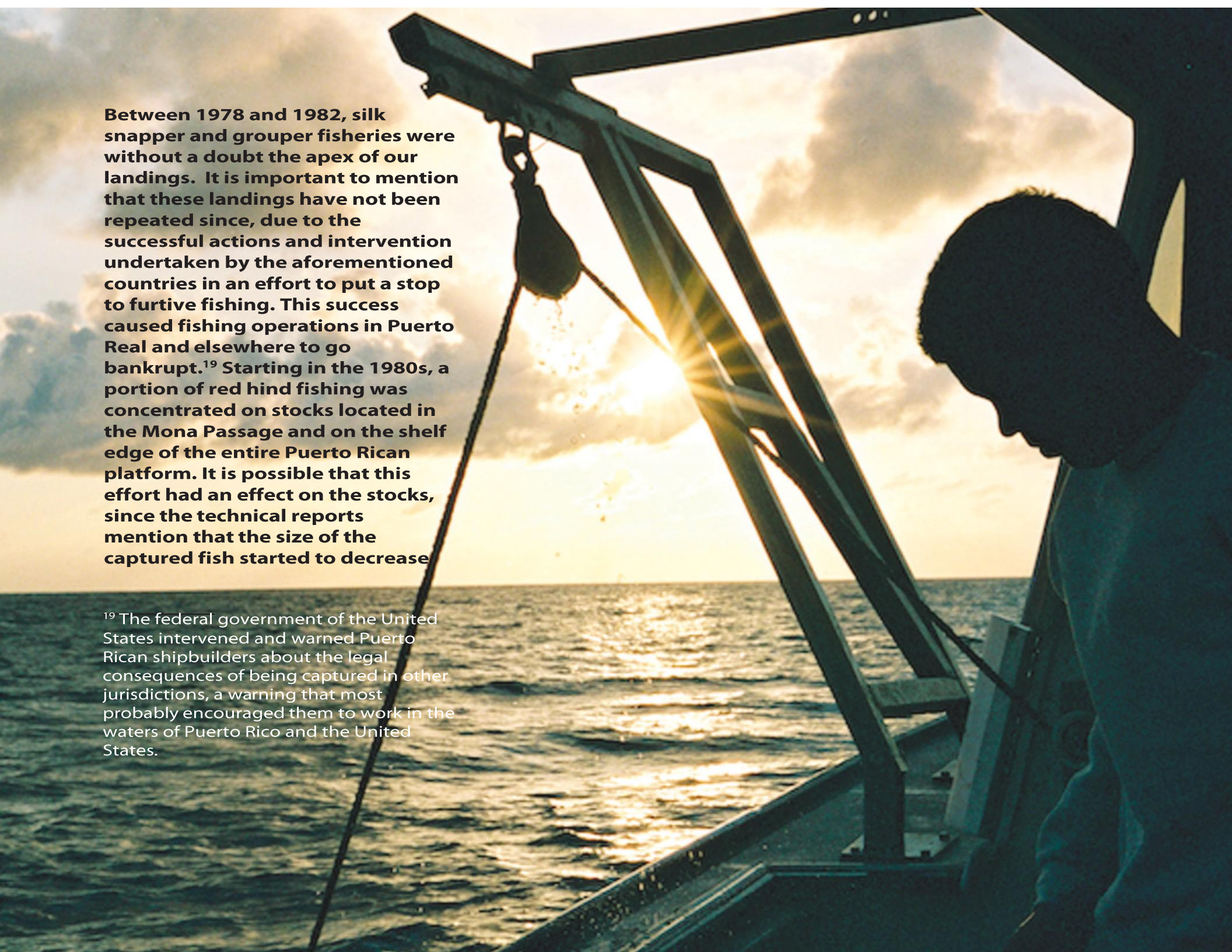
Back Home... Some Interesting Details

The development of fishing in Puerto Rico has slowly been effected, with small and sporadic investment of capital for the sector's improvement. Loan programs for vessels under **Community Action**[17] and other projects have allowed for the acquisition of motor vessels, some of which were initially constructed, to work with trawl nets or with larger tools like the fish traps used in shrimp territory in the United States. These vessels did not adapt very well to our fishing, and thus, many fishermen did not have the capacity to effectively utilize them on the insular shelf. The switchover from fishing with fish traps to fishing snappers in deep waters—*Lutjanidae*, mostly silk snapper, queen snapper, and moniama—with electric winches caused many of those vessels to be used for the fishing of silk snappers and groupers on the shelf edge of the platform, on fishing banks outside the platform, and on banks located in the jurisdiction of various nation-states in the Caribbean.

[17] The Community Action Agency invested, in the 1970s, several million dollars of federal funds in projects for the development of fishing and the strengthening of fishing communities. It also contributed to the construction of fishing installations and granted loans for the purchasing of fishing vessels and equipment.

This was carried out with boats that were provided by the government in the 1970s, although they were purchased, furnished, and prepared by local fishing entrepreneurs (who called themselves **shipbuilders**), who embarked, at the end of the '70s and the start of the '80s, on the capture of snappers in deep waters and distant territories.[18] It was part of the routine to observe the bulletin board, which served as itinerary for vessels from Puerto Real and Cabo Rojo. It included various Caribbean routes, such as: Cabo Engaño in the Dominican Republic, the Turks and Caicos Islands, Saba, Isla de Aves (a territory of Venezuela), St. Barts, and Nevis. The itinerary in other fisheries was similar and included routes to Pichincho, El Guineo, and the fishing banks located in the Mona Passage. The increase in landings in Puerto Rico was due to the acquisition of some vessels by the government. It was not possible to use them on the insular shelf and they were only productive on the fishing banks located outside of it. These fishing banks were mostly located in federal waters (beyond the 10.35 statutory miles or 9 nautical miles) and in the waters of other nations. Because of this, this fishing was often done furtively or illegally.

[18] A shipbuilder is an entrepreneur who prepares a boat for activities of a commercial nature, for example, fishing. They are the ones who provide the capital and supply the necessary money for the purchase of gear, equipment, and food, as well as guide the mission.



Between 1978 and 1982, silk snapper and grouper fisheries were without a doubt the apex of our landings. It is important to mention that these landings have not been repeated since, due to the successful actions and intervention undertaken by the aforementioned countries in an effort to put a stop to furtive fishing. This success caused fishing operations in Puerto Real and elsewhere to go bankrupt.[19] Starting in the 1980s, a portion of red hind fishing was concentrated on stocks located in the Mona Passage and on the shelf edge of the entire Puerto Rican platform. It is possible that this effort had an effect on the stocks, since the technical reports mention that the size of the captured fish started to decrease.

[19] The federal government of the United States intervened and warned Puerto Rican shipbuilders about the legal consequences of being captured in other jurisdictions, a warning that most probably encouraged them to work in the waters of Puerto Rico and the United States.

and the capture of individuals under the reproductive age increased, which is a bad sign, in terms of the health of the resource. A great number of the landings during this time of plenty (1982 was its apex) were carried out in the waters of other countries. The fishing statistics that were recorded by the government show, from this point onward, a decreasing pattern in silk snapper landings in deep waters. It is possible to theorize that instead of a collapse in the resource, this decrease had more to do with a change in fishing locations and strategies.[20] By the end of the 1990s, large vessels started to disappear, along with their builders and corporations. Many fishermen of the northeastern coast adapted to the new conditions in silk snapper fisheries, with smaller boats and day trips to the fishing banks in the Mona Passage: a far more concentrated and controlled effort with a reduction in the investment of capital.[21]

For those who think that fishing never had a future, the case of the silk snapper fishery is sufficient evidence that just like other countries with access to technology and to abundant fishing banks, Puerto Rico was able to make a worthy fishing effort. I am aware that fishing entrepreneurs in Cabo Rojo did everything they could in an effort to acquire fishing permits in other countries. They were never able to overcome the obstacles of sovereignty and the bureaucratic difficulties between host countries and the United States.[22] The nations of the Caribbean had other objections related to the circulation of vessels in their waters with the pretext of fishing. As a country, we came late to the game, since many Caribbean nations were protecting their EEZ and refused to grant permits for the utilization of resources that they themselves could take advantage of. The end to this tale, which I will not detail here, is widely known. Entrepreneurs and fishermen continued to fish in these waters and were captured and imprisoned, and their vessels were seized by the authorities of these countries.

While this took place, Puerto Rico was, ironically, the largest center for fish processing in the United States, the central point for tuna processing and the home of the largest tuna packaging companies:

[20] My argument is not that snapper stocks are currently in poor condition, but that these figures correspond to a fishing effort that was mostly undertaken outside of Puerto Rico's platform, in waters of distant countries.

[21] These comments are based on personal observations and an oral presentation given by Eugenio Piñeiro, president of the CFMC, alongside the fishermen Greg Engstrom and Nelson Crespo, in the Southeast Data, Assessment, and Review (SEDAR, part of NOAA Fisheries) meeting of January 26, 2009.

[22] My awareness of this issue stems from firsthand experience, at the end of the 1980s, when I helped entrepreneurs from Cabo Rojo in their efforts to acquire permits in order to fish in the Dominican Republic.

Star Kist and *Bumble Bee*. Tuna landings, made by large vessels (clippers) throughout the Pacific Ocean and the African Atlantic, were unloaded in Puerto Rico by refrigerator vessels, who bought the landings at sea and brought them refrigerated to later be boiled, shredded, and canned for the North American market. Some regional tuna populations, such as yellowfin tuna and the albacore, also transit in large numbers through our waters, but are not as abundant as the ones captured by tuna fishing vessels with their surrounding nets.

The truth is that there are some relatively abundant, pelagic resources in waters near Puerto Rico, which could have been the focus of a significant commercial fishery. In the 1990s, local fishermen—in particular recreational fishermen—observed the presence of longline fishing vessels in search of swordfish (*Xiphias gladius*) in order to sell it on the United States' market. Swordfish became one of the select delicacies of commercial gourmet cooking in the United States. During 1982 and 1983, the NMFS carried out some exploratory studies on stocks in Caribbean waters, particularly in Puerto Rico, the United States Virgin Islands, and the British Virgin Islands.

As a result of these explorations and the economic intentions of fishing firms from the United States to expand the areas designated for resource extraction, in 1984 a fleet of longline fishing vessels (around 15 vessels) from the Southeast of the United States arrived to take advantage of these stocks. Likewise, several Japanese and Taiwanese vessels, as well as others, arrived in the Caribbean and in our waters, including our EEZ, to take advantage of these resources as well. It is estimated that between 1985 and 1986, there were around 40 vessels in these waters extracting this resource. The highpoint of this effort was between 1987 and 1989, when it is calculated that there were around 70 vessels operating in the area. There was no accurate recording of fishing statistics on the landings from these longline vessels; rather, the available statistics were estimates based on the voluntary information that was offered by shipbuilders and fish buyers.

The longline vessels from the United States shared the waters of the Caribbean with vessels from Taiwan, Venezuela, and Japan, who fished, some in a furtive manner, these pelagic resources. They situated their hook lines (between one and five miles long) in the water column at the appropriate temperature for the capture of swordfish. However, when these lines were hoisted, the hooks crossed through areas of different temperatures, accidentally capturing wahoos, yellowfin tuna, dolphinfish, and marlins. The incidental capture of marlins (sailfish, white marlin, and blue marlin) motivated the community of recreational fishermen to oppose longline vessels. These efforts culminated in the Billfish Species Management Plan and the establishment of strict regulations to protect Highly Migratory Species (HMS). As a result, marlins were protected and the local

commercial fishing of these species was prohibited (e.g., hand fishing of marlins). A permit program was also established for the capture of pelagic species.

Local commercial fishermen are very clear on the issue that they were the most affected by this legislation, even though a dispensation was negotiated for a small quota for them to capture and sell marlins. This was never accomplished, which is the origin of an atmosphere of distrust toward the organizations and federal agencies that regulate these fisheries. It was also a great Pyrrhic victory, i.e., an expensive one, since many recreational and sport fishermen sold marlin landings, and with the new legislation they lost a source of income which they utilized to support their leisure activities.

In the grand scheme of things, the process described concerning longline fishing went mostly unnoticed among local producers; it was a great opportunity that was lost. It is not certain how many pounds of fish were captured by these longline fishing vessels, fish that could have been distributed on the local market, allowing for the development of new consumption and sales strategies. Little is known of what happened, but between 1990 and 1991 landings started to decline, as did the number of vessels in the Caribbean regions. Between 1992 and 1996, there was an estimated 6 to 15 vessels, with [annual] landings approximating 4 to 7 million pounds. Seven million pounds is the highest figure for fishing in Puerto Rico, which occurred when snappers were captured in the deep waters of the Caribbean and in the Mona Passage. In other words, that is the highest [annual] estimate of longline fish landings, the most official and precise figure that can be presented and equates to our best year of fishing.

To my understanding, the information available on the stocks of pelagic fish, swordfish, and highly migratory species (tuna and some sharks) is scarce for this part of the Atlantic Ocean. The NMFS has an interest in the expansion of these fisheries in the Caribbean (Puerto Rico and the United States Virgin Islands), though in a limited and controlled manner. Swordfish stocks suffered a noticeable decline in the 1990s, which is why the federal authorities regulated its capture through quotas, the establishment of a closed season, closure of areas, and restrictions on fishing gear. At present, the resource is in recovery, according to the NMFS; therefore, it is now possible to start issuing additional permits. However, the potential for captures in the Caribbean is not very high and it is probable that it will not go over 1 million pounds of tuna and swordfish, which would be shared with other fleets of the eastern United States.

Matters of Extreme Urgency Regarding Fishing and Fishermen in the 21st Century

Fishing in Puerto Rico is currently in a delicate state, and the solution to its problems is a difficult one. In this country, there has not been a concerted effort for its development. What we have done, as a country, does not compare to what other countries have done. We also do not possess vast fishing resources in our waters, capable of sustaining this type of industrial development. In terms of the consumption of fish, fish corrals[23] were important fishing gear for the capture of fresh fish; meanwhile, artisanal fishing was a way of complementing the income and the diet of coastal citizens.

However, our primary source for fish was salted cod from Europe, the United States, and Canada, especially from Newfoundland. In 1932, we fished 3.5 million pounds (wet fish, with its head and tail), while we imported 32 million pounds of dried cod, pure meat. Therein lies the historical difference.

[23] Fish corrals were an indigenous and European art, utilized in Puerto Rico until 1953, the year in which they were prohibited. The corral is a stockade or an enclosure which intercepted the movement of the fish in rivers and coastal lagoons. The fish were trapped in the corral or in smaller corrals called *chiqueros*. Afterwards, they were removed with nets and were sold fresh.

As a country, we took the first steps by improving fishing infrastructure and vessels; however, it stopped there. We lost many opportunities and one of them consisted of the development of a small commercial fleet of longline vessels which would have utilized, in a sustainable manner, the rich pelagic resources that transited through our waters. As the popular saying goes, *perdimos el barco* (we missed the boat), even though some visionary fishermen clamored for the government to invest in such a fleet. It was the wrong time: the resource was already declining due to the enormous pressure being applied by longline fishing vessels, and the fishing entrepreneurs of Puerto Rico—those that were able to invest capital—were already disappointed with the collapse of their incursions in the Caribbean. Other entrepreneurs found better proceeds in supplying foreign longline fishing vessels, and they obtained profits from the landings that were ceded to them at a low cost, which were later resold on the local market. The possibility of a local longline fishing fleet vanished into thin air.

Now What? A Difficult quandary!

Fishing in Puerto Rico is in the middle of a dilemma that has to be resolved. Landing figures demonstrated a decline in catch, which is probably due to a reduction in the number of fishermen and, perhaps, a shortage in the stocks of some species. The fishing statistics to which we have access are not the most accurate, but they are currently the best we can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acquire, due to the circumstances. This is why (along with a reaction to the Fishing Laws and Regulations of the DNER) many fishermen no longer register for licenses, do not provide landing statistics, or have simply abandoned fishing. Hereinafter, I present a list of urgent matters related to fishing that have been identified by fishermen, scientists, and managers, which we need to confront, discuss, and resolve.

The ecosystems and the critical dwellings of various commercial species are currently in a precarious state. Resource managers emphasize the concept of overfishing, but the truth is that more than 70% of mangrove forests have disappeared and estuaries have lost their original physical condition that transformed them into fish hatcheries and critical areas for marine and bird fauna. We have filled in mangroves, cut down forests, eliminated coastal lagoons, and eradicated wetlands in the name of health, the economy, and aesthetics. Thus, we have eliminated an important element for the survival of fish. Nobody has calculated the quantitative impact of these transformations on the reproductive capacities of fish. It is logical that a reduction in these dwellings has a direct impact on the availability of fish. However, it is known that fish can adapt to conditions of severe natural stress.

Ecosystems are constantly threatened by unsustainable development. Coral reefs, seagrass beds, *rastreales*, cays, and islets, remnants of coastal lagoons and estuaries that still have the capacity to serve as fish habitats, are threatened by deforestation, preparation of lots for construction, canalization of streams, elimination of estuaries, land erosion, disposal of materials in bodies of freshwater, and sedimentation of coastal waters and habitats. The dispersed sources of contamination, as well as the sources of untreated water emissions, affect the health of these habitats. The Aqueducts and Sewage Authority or AAA (Autoridad de Acueductos y Alcantarillados) with the consent of the Environmental Protection Agency (EPA) of the United States represents one of the most severe sources of contaminants for our waters, by providing a dispensation that allows the release, into the ocean, of water that has only received primary treatment, instead of secondary or

tertiary treatment. The greater the number of homes, the more decreased the system's capacity to process waste water, resulting in greater emissions. The number of septic tanks off the coastline also has an effect on water quality.

Ecosystems are threatened by hurricanes and climate change. Both of these issues are under public scrutiny at present and they are factors to be considered. Hurricanes have an enormous impact on the submarine and coastal landscape. They also have the capacity to eradicate poor coastal communities, as well as fragile or vulnerable infrastructure, as is the case with fishermen. Hurricanes put a stop to fishing activities for a specific amount of time and they force these producers to find employment in other sectors. Rising sea levels, a product of climate change, have an impact on coastal ecosystems and alter the beach's profile and the configuration of coastal settlements. We have to fear the impact on coral reefs, especially of global warming, which tends to acidify sea water and cause more carbon dioxide to concentrate, causing coralline structures to weaken and fish populations to decline.

Fishing communities are in danger as a consequence of coastal development and construction. The economic growth of tourism, of the coast as a central point for the sale of real estate, and of the beach as a vital recreational space have caused fishing communities to all but disappear. Foreigners and even locals invest in beach houses, summer apartments, and permanent residences. Our tax system benefits those that can invest in mortgage loans, and an alternative is to have a house and an apartment. In this manner, the construction and financial sectors are stimulated, while the occupation of the coast by condominiums is promoted. The high cost of property motivates many fishermen to sell their houses and properties or to live squeezed in between marinas, hotels, condominiums, and gated neighborhoods. The truth is that poor coastal communities, communities on plots of land, and communities with small piers are undergoing radical changes, and their future holds new construction projects in their interstices or in the periphery of their communities. Puerto Real, Joyuda, and Combate, in Cabo Rojo; La Parguera and Papayo, in Lajas; and the coast of Rincón are clear examples of the magnitude of this social change, which is even manifested in the language and the architecture.

Fishing communities compete for species and space with sport and recreational fishermen. An articulated but subtle conflict occurs between fishermen. What is the size of the landings by sport and recreational fishermen? The estimates are as numerous as the landings, but it is more reasonable to think that 10,000 fishermen could fish close to 3 million pounds a year. These estimates are an exaggeration; furthermore, the problem does not lie here, rather in sport and recreational fishermen who are not accounted for in the system. This is due to the fact that they do not offer or submit fishing statistics and it is unknown, at least officially, if they sell their landings.[24] It is true that the DNER has estimates from sport and recreational fishing, which is extracted from creel surveys and other sources. However, this data is not calculated in the appraisal of this stock. It seems that recreational fishermen compete for the same species with commercial fishermen, which includes: snappers, groupers, dolphinfish, kingfish, and tuna. They also compete for the same space for fishing and anchoring their vessels. Occupying the same spaces, particularly on the coast, creates economic opportunities for commercial fishermen: working as captains of recreational vessels, working in these vessels as bowmen, working on the care and maintenance of vessels, buying others' landings, and adding landings to their own assets.[25] However, these opportunities also create dissonance (i.e. having these jobs vs. their complaints regarding the displacement and eradication of their way of life).

There exists a global environmental movement against fishing that will affect commercial fishermen and those fishermen who subsist on their trade. This global movement is backed by various international environmental movements that wish to eradicate fishing as a way of life and establish no-catch natural reserves, where fishermen will have neither participation nor influence over the conservation of resources. Some international organizations have an open campaign against certain fishing gear, for example: fishing trawlers, trammel nets, fish traps, and longlines. The intention of these campaigns is to eliminate these types of fishing gear. We must pay attention to this situation, since our goal should

[24] We know, through reports and field observations, that some of the landings from recreational and sport activities are sold, violating the stipulations of Puerto Rico's Fishing Laws and Regulations, which indicate that "it is illegal for any recreational fisherman… to sell, trade, or barter with products of recreational fishing."

[25] The Fishing Act prohibits the sale of landings acquired through sport and recreational fishing. However, this is a customary practice.

not consist of the elimination of fishing; rather, it should include a search for alternatives for the sustainable use of resources. The elimination of fishing would herald a new set of problems, such as: the collapse of local economies and their connection to the sea, and the disappearance of a rich culture that has adapted to a marine environment, on many occasions respecting and protecting it. It is important to note that there exist environmental NGOs that do not share this elimination goal but, on the contrary, involve fishermen and their communities in the management process. On occasion, the interests of conservationists are not kept in check and they trample fishermen. In Saint Croix, United States Virgin Islands, fishermen have to contend with a multitude of marine areas under protection (some of them fostered by NGOs and others by the government), which barely leaves them with enough space to fish in. Some examples that illustrate this are: the monument of Buck Island to the north, which covers an important zone for pelagic fish, the East Marine Park, the Salt River Reserve, the prohibition on the fishing of red hind (*Epinephelus guttatus*) to the southeast of the Island, and the prohibition on the fishing of mutton snapper (*Lutjanus analis*) in Lang Bank, to the northeast. If we also add to this list the areas to the south that are in poor condition due to pollution and the destruction of habitats, competition with recreational divers, the shortage of pelagic resources (attributed to foreign longline vessels that operate to the east of the Island), and the narrow northern platform, the fishermen of Saint Croix have very little space left in which to fish. Thus, the imperative need to establish diverse marine reserves must be analyzed with care and with the necessary sensitivity in order to understand the current situation of fishermen. In other words, the development of protected marine areas should be undertaken with the participation and the active and decisive collaboration of fishermen. An example of this can be observed in the processes that led to the development and successful implementation of the following reserves: the Luis Peña Channel in Culebra, and Tres Palmas in Rincón, which have had the support of the DNER. It is prohibited to fish in both reserves, a measure supported by fisherman in order to allow the fish to flourish.

The data and fishing statistics to which we have access are meager and insufficient for the appropriate management of the resource. There is an urgent need for scientific information concerning fishing resources, which requires immediate resolution. The collection system for fishing statistics must be improved, as has been confirmed by field observations, by the testimonies of fishermen, and even by clarifications in studies about landings and the sources where the data comes from. For instance, with the implementation of the Fishing Act, considered by many fishermen

to be abusive, the reaction has been simply to not submit fishing statistics, which further aggravates the lack of data. Researchers, affiliated with coastal management and fisheries, have data which indicates that a considerable amount of pressure is being placed on marine resources. With some species, as is the case of the queen conch, there is good data available that permits good decision-making in terms of the management of the resource. However, very little is known about other populations; therefore, more scientific research is necessary for effective, fair, and appropriate decision-making. We must manage the resources with current data, but we can and must have access to better figures and models for analysis that are more adequate for our fisheries.[26] Accurate statistics are needed on fish landings, both commercial and recreational, so that managers, fishermen, and scientists have the most precise view possible of the effort, fishing mortality, and the resource's capacity for reproduction, as well as the capacity for sustaining a fishing effort of a certain magnitude. If this information is not available, we will not be capable (scientists, managers, and even fishermen) of protecting the resources in an effective manner. For this reason, it is important for fishermen to understand the scientific, economic, and social importance of fishing statistics.[27] This presents a great challenge for everyone.

There is an imperative need for the integration of fishermen into the management process of fishing resources. There may be some that will argue that fishermen are included, that they are invited to meetings, that they are called to convene in public assemblies held in hotels and community centers, that they are permitted to say what they think, confronting a tribunal of auditors and observers. It is true that our democratic system has mechanisms for the incorporation of commentary and opinions of all the sectors. This is one of its great virtues! However, this process is also one of its greatest tragedies, because it is plagued with faults and distrust by its participants. What do they do with this information? Will my comments be taken into consideration? These are questions that we hear constantly. The process can be highly structured and extremely confusing. But the truth is that this opportunity for dialogue transforms into a chance to rant against the authorities and for these to meet their detractors. It is a space for

[26] For example, models that take into consideration the many and varied species that are captured, with different fishing gear, on occasion, at the same time, and in the same places.

[27] Likewise, it is also important for scientists and managers to have a clear understanding of why fishermen are so reticent when it comes to reporting statistics.

adverse actions, for fighting and struggling. Sadly, this is what happens in a public assembly: people see it as a good chance to tear up the rule book and throw it in the face of government officers, or to scream. To work in favor of fisheries requires a love of nature, the sea, coastal communities, the species, science, and our children and grandchildren. In other words, it requires not insensitively working toward the development of the sector, but instead working for its sustainability, for the protection of nature and this traditional way of life.

We have not considered the fact that it is possible to design a process that will incorporate the full participation and consultation of fishermen, whereby they can interact as equals and as responsible individuals for the health of the resources, in the same way as those who manage them in an official and scientific capacity. "Let's sit down and have a roundtable discussion!" implored a fisherman in a public assembly. In other words, let us design a process through which we can all integrate ourselves in a dialogue aimed at the protection of populations and fishing stocks and the maintenance of the health and integrity of marine ecosystems and fishing communities.

If there is a crisis in the management of fisheries—and it is my belief that this is the case at present—then those of us who participate in the administration of the resource have the historical responsibility to administrate the stocks, adapting to the situation at hand, and integrating fishermen, with their experience and knowledge, into the process. Without them, it will be impossible to save these resources. I am aware, through my studies, that committed fishermen in possession of advance knowledge are cognizant of the current state of fisheries. They agree that the pressure has increased, that there are new fishermen in possession of poor conservation ethics, and that the available stocks are not sufficient for everybody. They recognize that resources may be in a precarious situation and that it is necessary to get involved in the issue in order to protect the resource, fishermen, and their families. At present, the CMFC and the DNER are evaluating protocols and strategies to properly integrate fishermen into the management of resources and protected areas, in such a way that we can take one of the necessary steps to overcome the current crisis.

There is a need to understand the impact fishing has on the communities that shelter them and to recognize the social and economic role of fishing. To understand fishing, we have to separate ourselves from the idea that little is produced. Fishing is a source of income

that permits the unemployed to obtain money and food, in the harsh reality of our current economy. Historically, it has served as a labor buffer zone which allows for life to continue without any major ordeals. We must understand this when the time comes to pass legislation related to who should have fishing permits and the distinction (which has been inaccurate, historically) between full-time fishermen and part-time fishermen. At present, fishing serves as a palliative for economic hardships and an additional source of protein and income for poor sectors.

In comparison, the capture and sale of fresh seafood performs a crucial role in the local gastronomy and diet, as well as the prosperity of seafood restaurants that serve local visitors and tourists. We must become better acquainted with the social and economic impact that fishing has on fishermen, fish vendors, shipbuilders, and the industry's workforce. The NMFS is currently carrying out studies of this nature, to be able to add information to the protection process being undertaken for the integrity of fishing communities, in the context of management. The work titled *Comunidades entrelazadas* (2008, Interconnected Communities), by David Griffith, Carlos García Quijano, and Manuel Valdés Pizzini, is an example of this.

We have a responsibility to discuss and explain our scientific concepts and to make them manageable and understandable to all the users of fishing resources. In the management of fisheries, there are talks about the **Gordon-Schaefer Curve**[28], decreasing production, maximum sustainable production, optimal production, overfishing, thresholds, schemes for limited entry, a reduction in efforts,

[28]This is a bio-economic model, graphically represented by a curve that permits us to visualize the effect of fishing efforts on stocks, in order to determine if the production is adequate or if it threatens the species being captured.

closing of aggregations, open seasons, marine fishing reserves, and total landings permitted, but none of these topics are explained to or shared with the community. It should be explained, with precision and simplicity, that it is a fact that if stocks continue to be exploited uncontrollably there will be no more species and, therefore, there will be no fishing for future generations.[29] The impression is that scientists and resource managers work from the premise that everything is known and that their methods are absolutely precise and their plans infallible. Nothing could be further from the truth. The situation has changed dramatically in the field of science. For example, the work of fishery biologist Daniel Pauly has exposed issues concerning the natural variability of stocks and the difficulty that models face in predicting, with any amount of precision, the behavior of populations; thus, it is necessary to proceed with caution. It is necessary to be honest and to dialogue with the users, explaining to them the advantages and the limitations of conservation plans. Also of equal importance is the need to emphasize that if we continue fishing at the current rate, there won't be any fishing for future generations. Fishing reserves are, in my opinion, one of the best ways to protect the ecosystems, safeguard the integrity of the habitat, protect the stocks, put into action mechanisms that will allow populations the ability to recuperate, and integrate fishermen into the protection process. It must be understood that reserves, by themselves, are not a panacea, an absolute solution. These reserves must be in harmony and work together with other fisheries' conservation and management strategies.[30]

Environmental Justice. Fishermen clamor for environmental justice; until this is addressed, it will be very difficult to find a middle ground that will allow collaboration for the benefit of conservation. When a fisherman commits an infraction—whether real or assumed—the state and federal authorities intervene immediately. Fishermen are questioned on the size of lobsters, the methods employed, the size of fish, and the location where they captured queen conch. Their vessels are registered, their sailing

[29] This can be achieved through chats, dialogues, articles in *Fuete y Verguilla*, and workshops with fishermen and scientists.

[30] We recommend the reading of *Fuete y Verguilla* Issue Number 4, Volume 2 (October 2008), which is dedicated to open seasons, and Issue Number 1, Volume 3 (February 2009), which presents the topic of Marine Fishing Reserves. These management strategies (open seasons and reserves) are clearly explained, and pros and cons are presented. *Fuete y Verguilla* is also available through the University of Puerto Rico Sea Grant College Program's webpage: http://www.seagrantpr.org/catalog/publications/fuete_verguilla.html.

requirements inspected, and their licenses investigated. They are asked to present their permits, they are charged for them, they are regulated till satisfied, and they are asked for detailed statistics on their landings. Fines tend to be onerous. Regardless of how low the fine is, though, it is still too much for a fisherman's income. Commercial fishermen are subject to the jurisdictions of the Commonwealth, which comprises up to 10.35 statutory miles (or 9 nautical miles). However, the perception is that recreational users and sport fishermen do what they want at high speeds, catching marine species without reservation; while on land, the overwhelming pace of development continues: deforestation, erosion, and sediment deposit in marine and coastal habitats occur without sanction. In their world view, "*la soga parte por lo más fino*" (the rope snaps at its weakest point). They are a people well-acquainted with this seafaring metaphor, based on the use of ropes, riggings, and knots. The vessel must be tied appropriately, with strong rope, so that it does not get loose and go adrift. The fishermen, the less powerful, have the impression that they carry the burden of having to receive the full weight of the law. They are that thin rope that is ripped by the waves of legislation, by the easy pressure of police interference, or by the rip current of management plans, open seasons, and conservation schemes. Meanwhile, others go unpunished. We are all in the same boat, but if we do not all row in the same direction, the vessel will remain directionless, with nowhere to dock.


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Conclusion

The current situation of our fishermen is very similar to that of fishermen in Nantucket and Long Island, to lobster fishermen in Maine, to Labrador fishermen in Canada, and to the **cayuco** users of Samaná, Dominican Republic.[31] They all face the destruction of the environment, shortage of stocks, invasion of exotic species, displacement of their traditional communities, competition with other fishermen (such as recreational fishermen), advances in conservation, climate change, and lack of incorporation into resource management, despite some efforts in this respect.

Our administrators are aware of this situation and they are doing everything possible, within the limitations of the system, to change it through innovative initiatives. There is much to consider, since vast sections of the sea remain unexplored. There are many—too many—years of work without obtaining the desired results.

It is not a matter of eradicating conservation efforts and fisheries management. Neither is it a matter of hiding the problem or blaming other processes for this situation. It is a matter of having a complete and historical view of what has happened here and comparing it with what has happened in the rest of the world, and of what is possible in Puerto Rico.

I do not presume to provide a recipe for a solution. However, I do advise that public policy must be conscious of the physical, political, sovereign, fiscal, and historical limitations (this is not the time for the industrial development of fishing) in order not to repeat previous errors and create false hope in the populace. This analysis of public policy puts these issues into perspective. I take advantage of this opportunity to outline a series of essential steps to start moving toward an ideal public policy regarding the development of fishing.

1. Incorporate fishermen into the management of fishing resources, in an open and democratic fashion, where they can genuinely participate in decision making so that their voice is heard. This mechanism has yet to be evaluated to ascertain whether it is functional and inclusive and can truthfully be classified as a participative and democratic mechanism for the voices of fishermen to

[31] A cayuco is a vessel made from a single piece of wood, without a keel, similar to a canoe, and it is used with paddles.

be heard, so that they may contribute to the process of formulating and reformulating public policy.

2. Stop, once and for all, the destruction of habitats, by assigning responsibilities to all the sectors that are involved. There are legal mechanisms available for this, within a countless number of laws, orders, and municipal ordinances. The question is: do we have the will and the mechanisms to make it work? All the studies carried out in Puerto Rico and the US Virgin Islands, in the last twenty years, indicate that there is consensus among the experts that the weak link in the conservation of fishery and natural resources, in general, is inefficiency in upholding the law.

3. Develop an aggressive program for the study of fishing resources on the platform and in the EEZ, in such a manner to provide a clear picture of the limitations and possibilities of—as well as the way toward—the sustainable use of these resources.

4. Create an academic program that will attend to the processes of coastal and marine resource management. The University of Puerto Rico, Mayagüez Campus, has one of the most prestigious departments of oceanography in the Caribbean and possibly in this hemisphere. However, it is one of the few, if not the only one, that doesn't have a program or a curricular sequence that covers marine issues, management, resource economy, and conservation. This is a painful and costly deficiency for the environment and needs to be corrected.

5. Explore other possibilities for the production of fish and shellfish, particularly, mariculture. This should not be carried out as a replacement for fishermen or as an alternative to their lifestyle, but as a supply option for the market and as a way to restock fishing resources. Presently, private capital, the University of Puerto Rico Sea Grant College Program, and the DNER are supporting and investing in this type of activity.

6. Explore, alongside fishermen and other important social agents—such as shipbuilders, fish distributors, and sellers—alternative methods for the protection and conservation of fishing resources for future generations. For

their continuing existence as a social group, it is imperative that we conserve and protect these resources, in a sustainable and appropriate manner.

7. As a corollary to the previous point, as well as to the subsequent one, we have to explore the possibilities of developing networks in marine areas that are protected by no-take zones, which defend populations of fish and other marine organisms, as well as critical habitats for marine species.

8. Initiate a systematic process for the restoration of habitats, with particular attention to estuaries. This is a massive task, but if we are honest and believe in conservation, we need to bear its weight. This restoration requires a radical transformation in the mentality of the general public as well as those involved in public policy.

9. Establish strict measures to minimize the contamination and destruction of wetlands and estuaries.

10. Improve the quality of our waters and protect the health of our marine habitats through secondary and tertiary treatment of wastewater produced by the AAA.

11. Resolve, once and for all, the problem (whether real or perceived) of injustice in the enforcement of fishing regulations and laws, by establishing responsibilities upon everybody who plays a role in the fishery resources.

12. Include recreational fishermen in the fishing statistics systems, in order to have a better understanding of the true impact of extractions on all the available stocks.

13. Protect the integrity of fishing communities and invest in their future. Fishing communities have played an important role in the defense of this space and the conservation of species. They have also been guardians of important cultural traditions and folklore that we celebrate with admiration. Likewise, they are a crucial element in our tourism industry because they provide restaurants with fresh fish, one of the most important sources of municipal income and local employment. Fishing has served the people of the coast as a palliative in moments of financial stress.

Therefore, when designing management programs that eliminate this industry's work force, we have to consider the fiscal resources available in order to lessen the effects they have. Those of us who work in these occupations have the duty to protect them in the face of development and uncontrolled construction activities (the urban explosion in coastal areas) that threaten to displace them. Many coastal communities have slowly but surely been transformed into elite communities. This means that they undergo social changes due to the introduction of wealthy outsiders buying beach property.[32] This process has triggered important social and cultural changes along the coast and in the fishing communities of Puerto Rico.

14. The development of joint educational and community outreach programs is of vital importance. In other words, the scientists and managers can learn from the fishermen's empirical knowledge (known as TEK, or Traditional Ecological Knowledge)[33], and the fishermen, in turn, can learn from the theories and practices employed by the

scientists and managers. There is a need for the creation of an educational platform that will connect this process in a transparent and effective manner. The Sea College Program and the DNER, among others, need to take the

[32] This process is known as gentrification, and it occurs in poor urban areas that are revitalized. The local population is relocated to other areas while the urban areas are repopulated by people of higher social classes.

[33] Some scholars prefer to call it Local Ecological Knowledge or LEK.

initiative to start a dialogue based on the points presented in this work.

15. Outline, as a product of the collaborative work between all those involved, a public policy in harmony with the resources, the ecosystems, and the producers.

16. Become acquainted with the impact and the economic valuation of fishing, in all its dimensions, in terms of labor (How many direct or indirect jobs does it generate?), its role in the diet of coastal communities, the creation of income, investment of capital and technological innovations, and the value that is added to the landings through the processing and preparation of fish and seafood in local gastronomy. In terms of development and economic possibilities, fishing falls under the jurisdiction of the ELA's Department of Agriculture. This agency can commence carrying out studies on the value of fishing production in comparison with other agricultural products. The products of fishing and the creation of income are, probably, greater than some agricultural products that have more exposure in the media and receive more help than the fishing sector.

17. Disseminate more information about the impact of fishing seasons and marine reserves on fish stocks and populations, and clearly explain the biological, economic, and social benefits and damages of fishing seasons and regulations. On this topic, it is important that each new fishing season or marine reserve that is designed and implemented be accompanied by a study of the socioeconomic impact of said action. I have included here the particular case of the regulations that apply to lobsters, to explain the logic and common sense of the limits in carapace length and of the capture of individuals with hard roe. Fishermen and resource managers should be well acquainted with the possible impacts of said actions, for example: a reduction in landings, displacement of fishermen into other areas, an increase in fishing pressure on said areas, an increase in the price of certain species, a change in the fishing gear that is used, the abandonment of fishing on the part of a significant amount of fishermen, an increase in the stocks in the region, the protection of certain

species, and the growth (in size and number) of their populations, among others. The aforementioned analysis is necessary for an informed and fair process of decision-making.

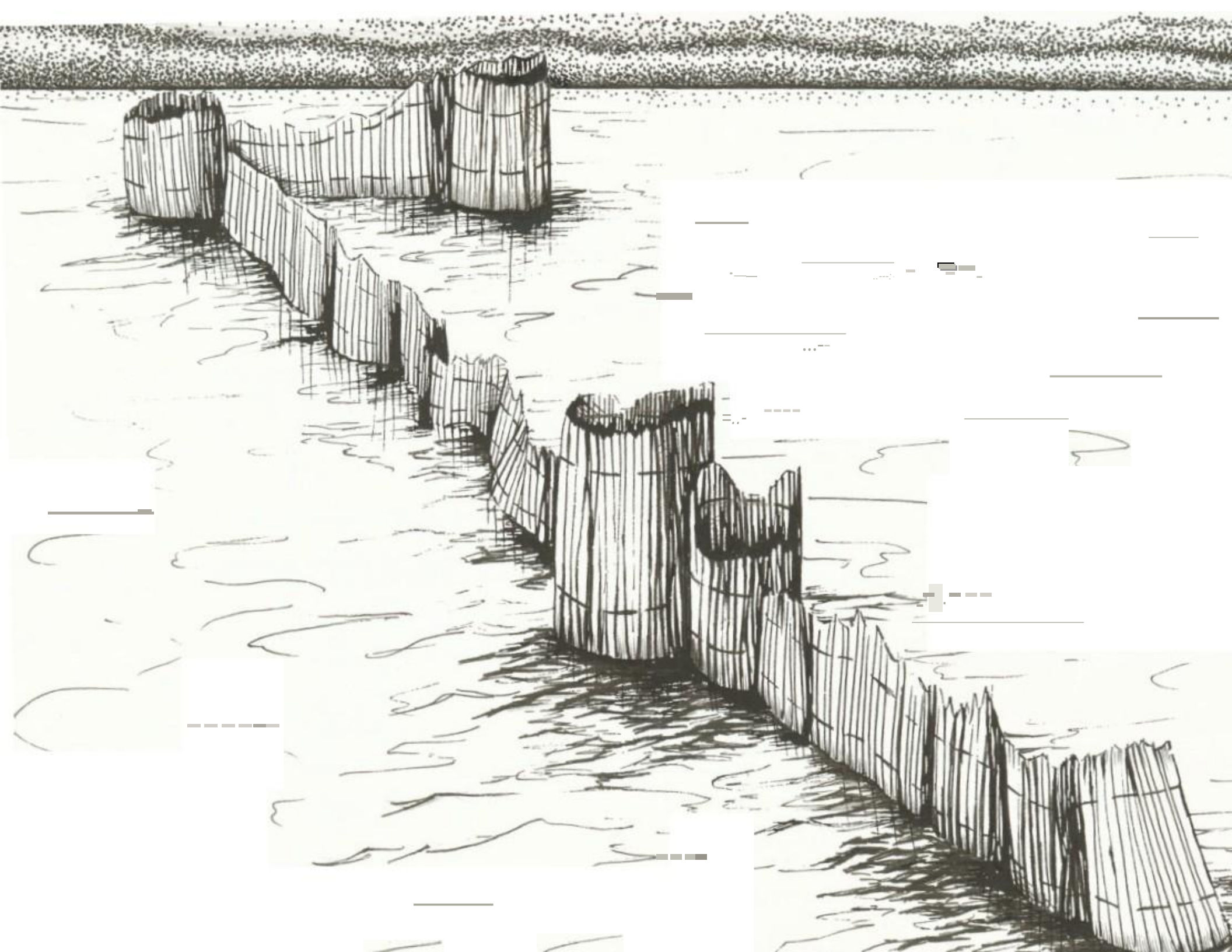
Public policy on fishing should have the consensus and participation of all the parts that are involved: fishermen, entrepreneurs, biologists, managers, economists, public policy workers, and specific agencies, such as: municipalities, the DNER, the Department of Agriculture, the legislative branch, and the Fishing Council of Puerto Rico. The information that is circulated and discussed should be as clear as possible, thereby allowing the actions taken to be known and concerted by all the parties involved. For example, the DNER and the CMFC can work to protect certain species by means of fishing seasons or fishing regulations. These actions must be in accordance with the actions of the Legislature, the municipalities, and the Department of Agriculture, for the benefit of the social and economic development of the fishing sector, in order not to undermine the efforts to conserve the resources. As long as public policy continues to lack institutional coherency—in the form of a defined goal with objectives—there is very little that can be done to benefit this important sector of the country. This is not an easy task. It is an uphill battle; even writing about it is difficult, requiring much effort and multiple revisions, and we have barely breached the surface of a complex and specific sector.

The ideas, data, examples, and processes contained in this work are the result of my perception derived from interviews, conversations, and discussions with fishermen, colleagues, and resource administrators, as well as scientists. For many years, I have committed myself to the task of trying to understand fishing. To this end, I have visited the historical archives in Maryland, Washington D.C., San Juan, San Germán, St. John, and Terra Nova, in order to examine their documents. I have visited fishing villages, coastal communities, and markets in Puerto Rico, as well as some in the United States, the US Virgin Islands, Hawaii, Guadalupe, Saint Lucia, Trinidad, and the Dominican Republic. In order to process this, I have examined a countless number of reports and have analyzed the results of studies on trammel nets, fish traps, recreational and sport fishing, and recreational sailing, as well as the life histories that narrate the work experiences of fishermen.

I have closely followed the complexity of fishing with fish traps, on the platform, measuring its location from Playa Sucia to Guánica; zigzagging among corals, *rastreales*, and shallows.

I have attempted to explain the rugged path of coastal fishing in Las Coronas, La Marca Vieja, El Ron, and across Tourmaline. I have addressed the shortage of resources and vicissitudes in the fishing of silk snappers. I have also addressed navigating, fishing, gutting, and packaging silk and queen snappers in Pichincho, El Guineo, El Banco del Medio, El Tostón, between Mona and Desecheo. I lived in Puerto Real, Cabo Rojo, for three years, in order to personally experience the shortages in resources, the poverty of fishing, and how hard it is to work in the fishing sector there.

The years dedicated to this study and the experience accumulated thereby do not make me an expert or authorize me to push a specific agenda, but they do motivate me to point out the processes that have formed this important sector, and to warn about its future possibilities.



A Brief Chronology of Fishing in Puerto Rico

1000
Groups of aborigines—hunters, fishermen, and food collectors, as well as the agro-potter groups, food producers that preceded them—depended on the fishing resources available in the sea and rivers.

1400
The main source of animal protein for the Taínos came from fishing, and they had fishing corrals that were under the control of the caciques. On the coast (mangroves) and in the sea, they fished queen conch, mangrove oysters, clams, crabs, reef fish, sea turtles, and manatees.

1500
The Spanish colonization marked the arrival of the obsession with codfish and preserves. There were attempts to develop fishermen camps to supply the local demand for fish.

1650
The colonizers adopted the native fishing corrals, which were very similar to Spanish stops and stockades as well as to African corrals. The towns of San Juan and San Germán offered in a public auction the right to build and use corrals in rivers, channels, and other parts of estuaries.

1720
Contraband was the central point of the local economy. Miguel Henríquez was a corsair and one of the most influential people on the island. He transformed San Juan into an important maritime center for seafaring people, as well as for fishing activity.

1750
Fishing corrals were the most important fishing gear on the island. The landings were sold in the capital, in urban areas, or in the settlements near the corrals. The corrals trapped sea breams, white mullet, snappers, and groupers in mangroves, river deltas, and channels. Affluent farmers leased these corrals, and their stewards or trusted laborers worked them. The fish was absolutely fresh, since it was alive in the corral.

1796
A Royal Decree circulated around the Island which established the Gente de Mar Labor Union, and everyone that used vessels to fish was required to join. In Puerto Rico, the members of the labor union served the maritime force as pilots, shipwrights, and carpenters, among others. The union's patron was Our Lady of Mount Carmel, and her followers had the responsibility of her devotion.

Whoever wished to fish at sea, in a vessel and with fishing gear, had to be part of the union.

1800
Coastal towns had a combination of fishing activities and port activities: commerce, contraband, and naval work. Roberto Cofresí was a merchant, smuggler, owner of a letter of marque and reprisal (permit to intervene with foreign vessels and commandeer them), and fisherman. Afterwards, he dedicated himself to piracy.

1803
In this year, the first known census was carried out, in which approximately 1,500 fishermen were listed, most of them from the west region. The most common types of fishing gear were: fish traps, drag nets, hand-dragged nets, cast nets, fishing lines, and corrals. A good number of fishermen worked without a permit, that is to say, they were not registered in the labor union. The majority of them were farmers who fished occasionally.

1850
Fishing was a complimentary activity to the agricultural activity in the sugar cane fields. In various haciendas, the slaves were ordered to fish in order to feed their owners and to supplement their own sustenance. Countrymen and rural workers (freed) fished for sustenance. The number of coastal town councils increased, so they asked the central government to allow them to gain benefits through the leasing of fishing corrals. There were conflicts regarding profits among the members of the Gente de Mar Labor Union, the councils, the marina, and the corral workers.

1860
The United States was one of the primary suppliers of salted fish in Puerto Rico. Toward the end of the XIX century, England, through its Canadian territories, started to import codfish to the Island.

1900
There arrived on the Island, alongside the military government of the United States, the notion that all citizens had the right to fish in any particular area; thus corral owners no longer had exclusive rights to fish in the areas that were granted to them. This brought complications in terms of competition and violence among the people of the coast. In this year, there were 1,500 fishermen, the majority of whom used sailboats, canoes, and small vessels called *yolas* with paddles. Fish traps were the most important fishing method, followed by drag nets, hand-dragged nets, and fishing lines.

1901
The sugar cane industry became the primary activity in the country. Rural workers without land became aggregates in estates and in sugar cane, coffee, and minor fruit fields. Fishing served as food for sugar cane workers during the slow period of the harvest, a period that was christened "La Bruja" (The Witch)

1905 onward
Canadian codfish dominated Puerto Ricans' diet and dishes.

1930 onward
A slow transformation process of Puerto Real's fishing fleet in Cabo Rojo commenced, adapting internal combustion engines for sloops and other sailboats. They fished snappers and groupers on the shelf edge and in the Mona Passage.

1933 onward
Experiments were carried out to try to cultivate exotic freshwater species, such as carp and trout.

1934
The Fish and Wildlife division was created in the Department of Agriculture of the United States.

1936
Fisheries became regulated by the Fishing Act, Number 83, of the 13th of May.

1940 onward
Fish shops with cold rooms were developed, which were called "neveras" (refrigerators), and their owners were referred to as "neveristas" (refrigerator owners), in various parts of the Island, but with greater force in Puerto Real, Cabo Rojo.

1941
Start of operations of the Fisheries Research Laboratory, in Cabo Rojo, which was dedicated to exploring new areas for the development of fishing.

1950 onward
Alongside the industrial development program "*Manos a la Obra*" [Let's Get Down to Work], there was also an effort to adapt outboard motors for yolas, loans were awarded for vessels and fishing gear, and funds were provided for the construction of facilities and docks for fishermen. This moment marks the beginning of the development of fishing villages.

1953
Fishing corrals were prohibited, due to the pressure from recreational fishermen who saw them as primitive fishing gear which annihilated the fish.

1958
This year saw the emergence of the Credit Agency for Fishers in the Department of Commerce and Agriculture of Puerto Rico.

1963
The Program for Minimum Facilities for fishing villages was created by the Department of Commerce and Agriculture.

1967
The Commercial Fisheries Statistics Program or PEPC (Programa de Estadísticas Pesqueras Comerciales) was established.

1970
The Community Action Agency was established, which started an aggressive purchase program for commercial fishing vessels.

1972
Through an Organic Law, the Department of Natural Resources was created, an entity that took charge of coastal and marine issues, among other assignments.

1975
The vessels purchased with funds from Community Action were used for fishing silk snappers on the shelf edge, on fishing banks located outside the insular shelf, and in the territorial waters of various Caribbean countries. During this period, fish trap fishers in the west started to change their fishing gear and to outfit their vessels with electric winches, in order to fish in deep waters with fishing line.

1975-1976
The Commercial Fisheries Laboratory of the Department of Agriculture published a series of written works on fisheries' production, fish aggregations, the names of fish, and fishing areas, which to date remains one of the primary sources of information concerning this period. This effort has not been equaled.

1975 onward
The struggle of Vieques fishermen against the United States Marine Corps intensified.

1976
The CFMC was established, marking the beginning of the management of fishing stocks in federal jurisdictions; the first plans for the management of various species were being elaborated.

1978-82
This was the peak period for fishing silk snappers.

1979-1988
There was a considerable decline in reported landings, from 7.9 million pounds in 1982, to 2 million pounds in 1988.

1979
CODREMAR was created, an agency that centralized all the efforts in the research, education, conservation, and development of fishing. It was responsible for helping fishers organize themselves in associations. Due to a decree, CODREMAR disappeared in 1990. The majority of the functions of this agency passed to the DNER in 1991, including the Fisheries Research Laboratory.

Fishermen organized the Congress of Eastern Fishers in order to consolidate their efforts and to ask the government for assistance and social justice. In the 1980s, the Congress of Western Fishers was organized, which mobilized the fishermen of the Island's western region.

1980 onward
Fishermen associations became a vehicle through which fishermen channeled their claims and social struggles.

1982
The United States' longline fishing fleet arrived with the intention of utilizing swordfish stocks.

1990
In this decade, the usage of trammel nets and *mayorquines* by fishermen increased significantly.

1992
The fishermen of Puerto Real were systematically imprisoned due to their illegal intrusion into The Bahamas and into the islands of Turks and Caicos. These arrests continued throughout the decade.

1994
A process was initiated for the development of a marine fishing reserve in Turrumote Cay, La Parguera, by local fishermen and scientists from the Department of Marine Sciences. They were unable to establish the reserve. The University of Puerto Rico Sea Grant College Program started a research initiative in marine reserves.

1998
Law Number 278 was created, a Fishing Act which authorized the DNER to develop regulations for the conservation of fishing resources: "To establish a new Fisheries Law in Puerto Rico; to redefine the concepts of fisheries, fish, and fishermen, as well as to define other concepts; to concede rights and duties to the Secretary of the DNER in order to regulate fishing; to establish penalties; to determine administrative processes; and to annul Law Number 83 of the 13th of March of 1936, according to its revision."

2000
The Luis Peña Natural Reserve was established in

Culebra, the first marine area to be protected with regulations for a no-take zone. Fishermen and scientists, together with the DNER, encouraged the development of the reserve.

2002
Diving surpassed fish traps in the number of landings and became the most productive fishing technique.

2004
Through legislation, the Tres Palmas Marine Reserve was created in Rincón. Through an Administrative Order, the capture of any type of organism was prohibited on the reserve, which was widely supported by the community and by fishermen.

2004
On March 11, 2004, Fishing Regulation, Number 6768 was established, for the purpose of administrating fisheries in the territorial waters of the Commonwealth of Puerto Rico.

2009
Law Number 68 of the 11th of August of 2009 was created, in order to "grant lifetime licenses to commercial fishermen, to those who work full-time, to those who are sixty (60) years old or older, and/or to those who are pensioned due to a disability to be exempted from the processes of applying for special permits; and in order to authorize the renewal of licenses for Novice Commercial Fishermen for only one (1) year."

2010
The "New Fishing Regulations" were presented, i.e., the amendments to the Regulations, which included provisions for the use of drag nets and demarcations for fishing on the Island of Mona and Monito Natural Reserve, among other considerations.

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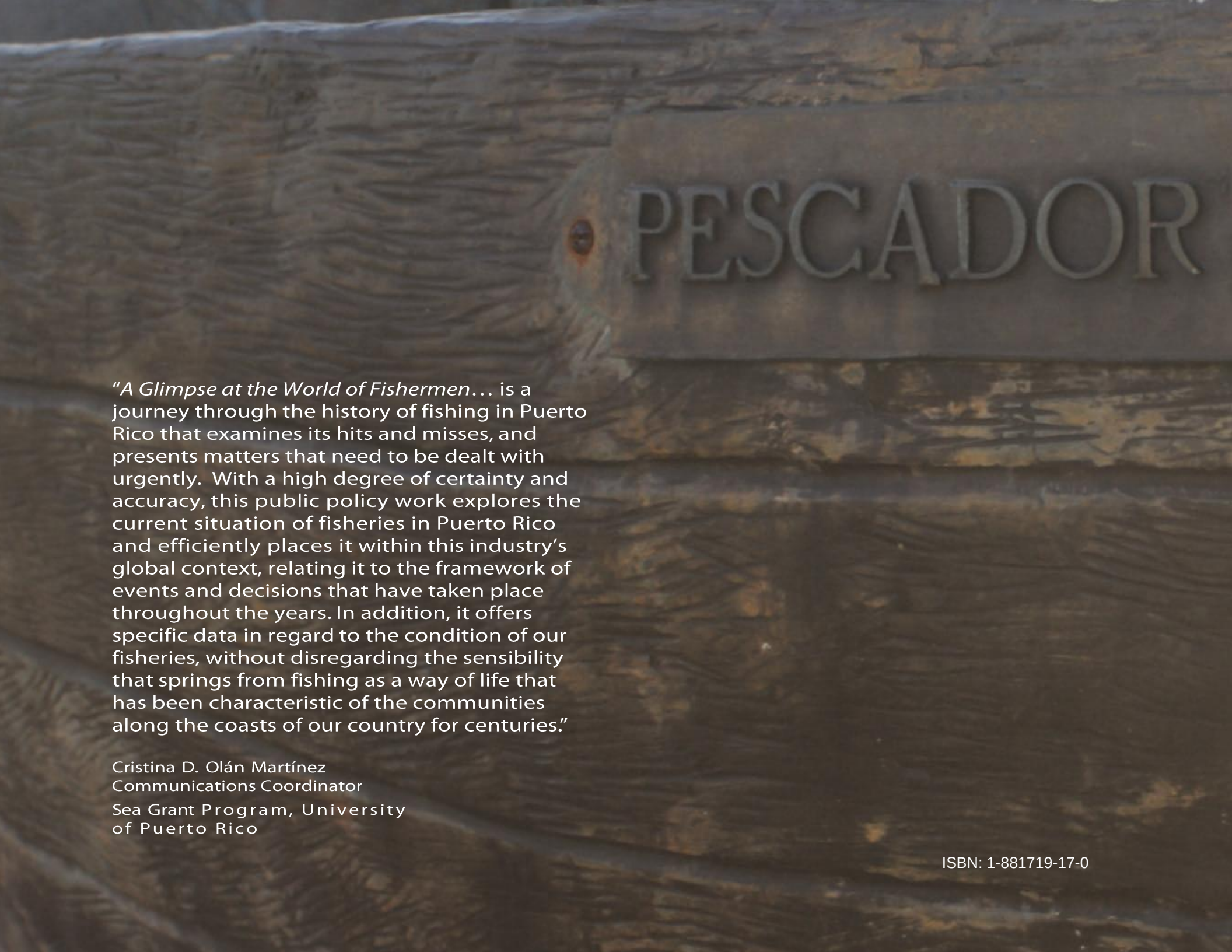

"*A Glimpse at the World of Fishermen*… is a journey through the history of fishing in Puerto Rico that examines its hits and misses, and presents matters that need to be dealt with urgently. With a high degree of certainty and accuracy, this public policy work explores the current situation of fisheries in Puerto Rico and efficiently places it within this industry's global context, relating it to the framework of events and decisions that have taken place throughout the years. In addition, it offers specific data in regard to the condition of our fisheries, without disregarding the sensibility that springs from fishing as a way of life that has been characteristic of the communities along the coasts of our country for centuries."

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